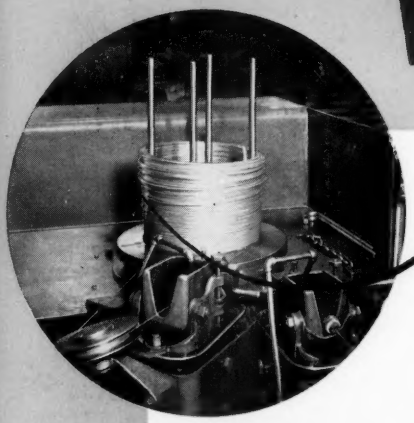
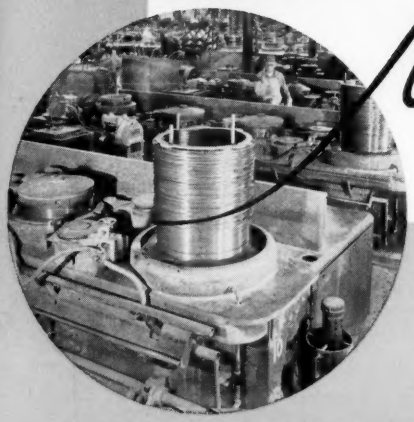
MARCH 1948

WIRE AND WIRE PRODUCTS

TWO GREAT NAMES IN WIRE . . .



Vaughn Motoblok



Vaughn Motoblok

"Quick on the Draw!"

FOR BETTER, FASTER

MORE VERSATILE

WIRE PRODUCTION

VAUGHN MACHINERY

PROFITABLY USED BY LEADING
WIRE MILLS SINCE 1871 . . .

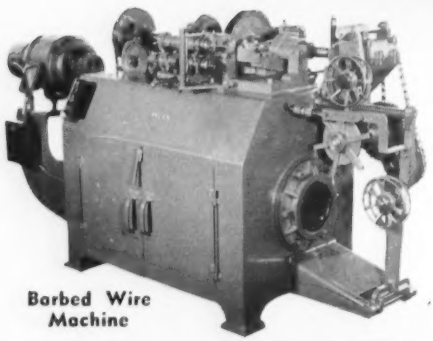
THE VAUGHN MACHINERY CO.
CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

Wean EQUIPMENT Corporation

8-inch Single Strand
Wire Flattening Mill
With Wire Straighteners



Barbed Wire
Machine

The WEAN EQUIPMENT CORPORATION is recognized as a specialist in high-efficiency strip and wire mill equipment.

COLD ROLLING MACHINERY

For 36" Wide Material and Narrower

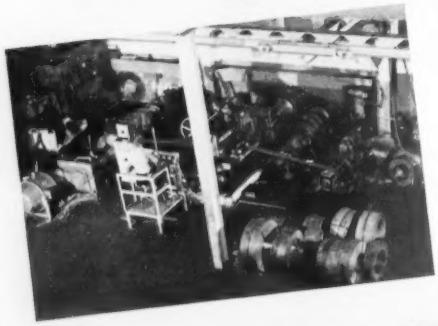
MILLS — REELS — SLITTERS — LEVELERS
COILERS — EDGERS — SCALE BREAKERS — SHEARS
SCRAP BALLERS — CONTINUOUS PICKLING

WIRE MILL EQUIPMENT

PATENTING, GALVANIZING AND TINNING TAKE-UP FRAMES
WIRE FLATTENING MILLS — SPOOLERS
NAIL GALVANIZING AND BLUEING MACHINES
BARBED WIRE AND FIELD FENCE MACHINES

WEAN EQUIPMENT CORPORATION

CLEVELAND • OHIO



Wean
Slitting Line

No. 1155
Field Fence
Machine

Shopping for your die room?

You don't try to catch fish with a bent pin *these* days. You've got to have the best equipment to meet today's tough competition.

That's why we're offering you the assistance of our carbide die specialists when you're choosing your die-room equipment.

You'll get faster, *better* die finishing with equipment made or approved by Carboloy.

This help with your selection of die-room equipment is just one phase (the third) of the four-point *Complete Package Die Service* that Carboloy offers all its customers *without charge.*

The Carboloy four-point *Complete Package* Die Service:

1—Service centers and field engineers to help you

2—Free training for your die-room personnel

3—Recommendations for most efficient die-room equipment and operation

4—Local stocks to supply you quickly

You get all four when you specify Carboloy Cemented Carbide dies—and they're yours at no extra cost!

And when you shop for carbides—

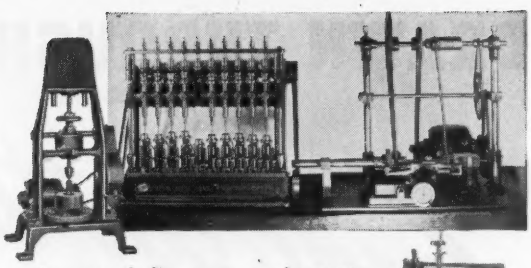
Remember that the *greatest service* Carboloy offers its customers is in the outstanding quality and the wide range of the drawing products it manufactures.

Carboloy's line of wire, bar and tube-drawing dies is just as complete as its package services to its customers.

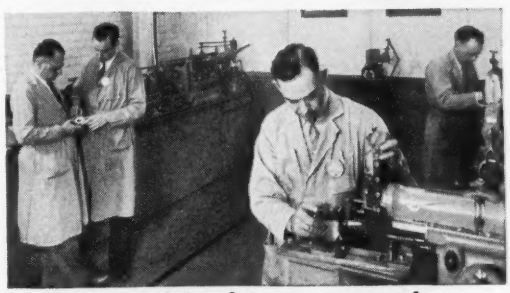
Ask for full information on the four Carboloy special services and the wide range of Carboloy drawing dies which make up the Carboloy *Complete Package Die Service.*

And ask for the 64-page DIE SERVICE MANUAL, D-119, too. It's the best of its kind in the field. *Carboloy Company, Inc., 11171 E. 8 Mile Road, Detroit 32, Michigan.*

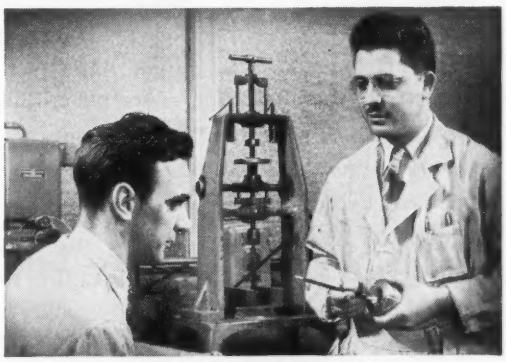
Specify CARBOLOY®
CEMENTED CARBIDE
For "Complete Package" Die Service



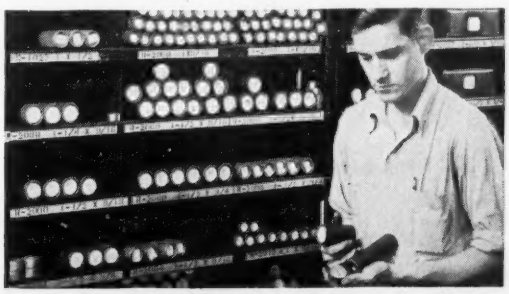
Approved die-room equipment
Recommendations for most efficient die-room equipment and operation. Die finishing and servicing equipment made or recommended by Carboloy means *faster, better die finishing.*



Free training for your personnel
Free instruction in carbide die application and maintenance methods for your die-room personnel . . . sure to benefit both veteran worker and "new man" and to *raise die-room efficiency.*



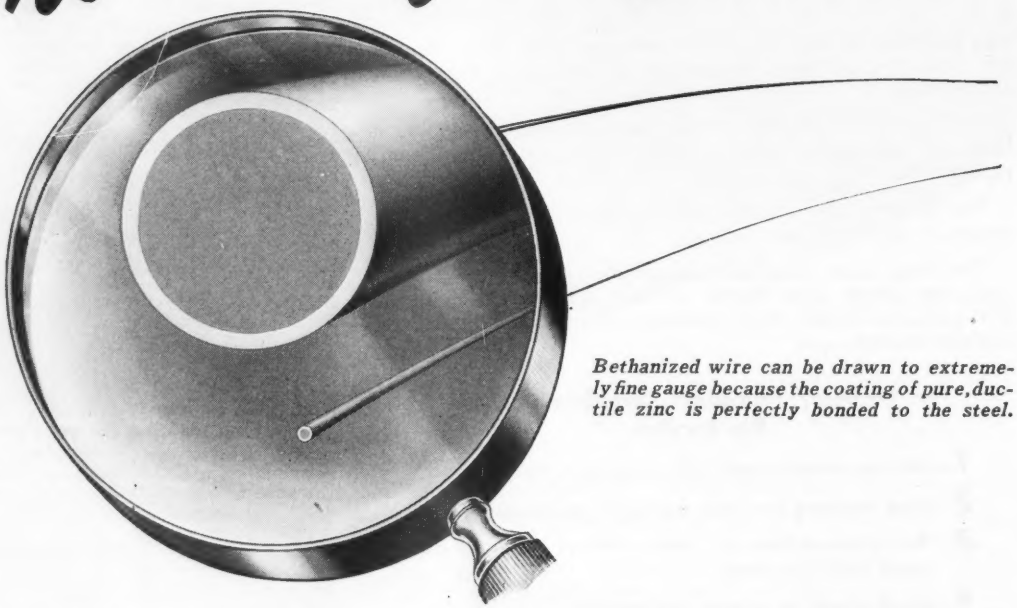
Service centers and field engineers
Help with die servicing and finishing problems: well-equipped *die service centers* in Detroit, Chicago, Pittsburgh, Thomaston, Conn. . . . experienced, capable *field engineers* in important wire drawing areas.



Local stocks of standards—fast deliveries
Complete *stocks of most commonly used standards* kept in metal working areas from coast to coast: Detroit, Los Angeles, Chicago, Pittsburgh and Newark. Speedy delivery to meet tight schedules.

DRAWN THROUGH 49 DIES AND THE

Zinc coating stays put



Bethanized wire can be drawn to extremely fine gauge because the coating of pure, ductile zinc is perfectly bonded to the steel.

A request for the production of some 3-mil filament wire was tackled soon after the development of the bethanizing process by Bethlehem. It was decided to experiment by drawing fine wire directly from a 16-gauge (.0625 in.) soft steel wire having a coating weight of about 0.6 ounces of zinc per sq ft of surface. This bethanized wire was then successfully drawn through *forty-nine* dies to a diameter of 0.0033 inches *without any loss of zinc coating.*

This unusual test is proof, not only of the excellent ductility and perfect coating bond, but of the high-quality steel as well. Bethanizing is a unique electrolytic process by which pure zinc is deposited atom by atom in a uniform coating on the steel wire.

You can do a better job with bethanized wire. *Here's why:*

- ★ Ideal for Severe Forming. The ductile coating permits drastic deformation.
- ★ Extra Corrosion-Resistance. The coating is uniform and tightly-bonded.
- ★ Smooth, Lustrous Appearance. Here's extra sales appeal for wire products.
- ★ Coating Weights to Fit the Job. Any predetermined weight of zinc within practical limits can be applied.
- ★ Long Coating Life. The zinc is 99.9 per cent pure.
- ★ Wide Range of Tempers. Whether temper must be hard or soft, the wire can be bethanized.

We suggest that you plan now to give bethanized wire a test in your plant. Just phone the nearest Bethlehem district office or drop a line to us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

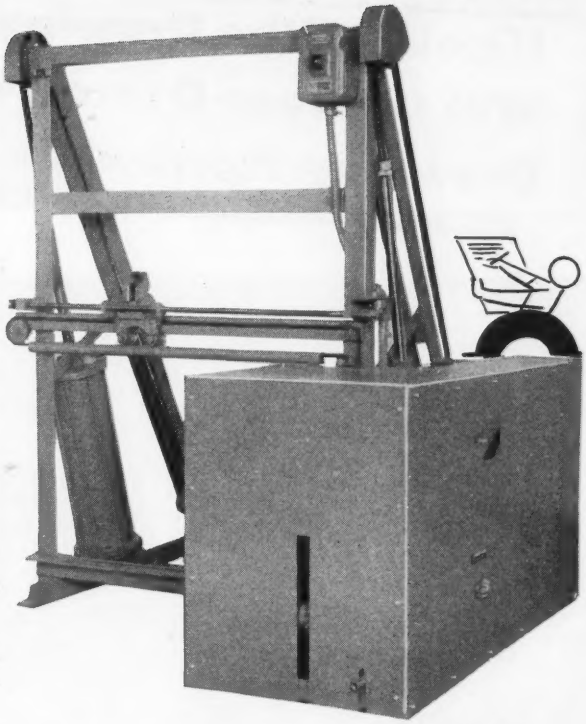
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ Bethanized Wire ★

BETHLEHEM STEEL

WIRE & WIRE PRODUCTS, Vol. 23, No. 3, March, 1948. Publication Office, at 61 Cliff Street, New York 7, N. Y. Executive Office, 300 Main Street, Stamford, Conn. Published monthly by the Quinn-Brown Corp., Richard E. Brown, President; R. S. Spengel, Secy. and Treas. Subscription price: U. S., $5.00; Canada, $5.00 per year; 50 cents per copy; Foreign, $7.50 per year. Entered as second class matter, June 14, 1946, at the Post Office, New York, N. Y., under Act of March 3, 1879.

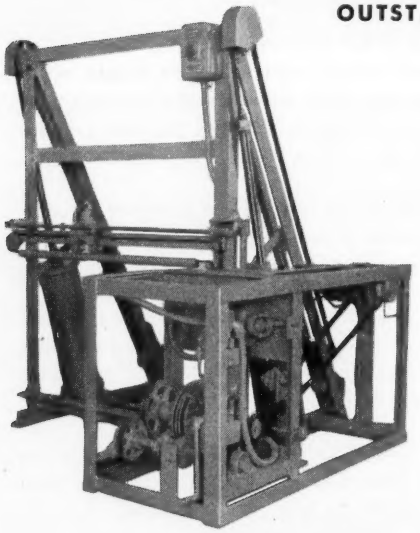
REEL Take-Ups



Shown here 24" to 48" reel capacity

Designed

To Meet Your Reeling Requirements From Standard Unit Arrangements!



48" Reel capacity take-up. External drive with slip-clutch showing drive mechanism.

OUTSTANDING JLE REEL TAKE-UP FEATURES:

1. Complete design flexibility. Standard units easily adapted to your drive requirements!
2. Pneumatic reel lift. No back-breaking reel-handling effort!
3. 18" to 84" diameter reels. Available in 5 frame sizes.
4. Rugged frame. Welded unit construction.
5. Traverse mechanism is quickly and steplessly adjustable for wire size and reel width.
6. Slip-clutch (optional) for trouble-free manual or automatic torque control.

JLE TAKE-UPS AVAILABLE IN FOLLOWING DRIVES:

MOTOR DRIVE

Constant-reel-shaft speed.
Adjustable constant-reel-shaft speed . . . 4 to 1 range.
Above drives with slip-clutch with or without constant-wire-tension . . . for take-up from capstan of any machine.
Adjustable *constant-wire-speed*, electronic or mechanical control.
Wide speed range available.

EXTERNAL DRIVE

Driven from capstan of any machine through slip-clutch . . . with or without *constant-wire-tension.*

★ ★ ★

Your specifications will receive prompt quotation.

JAMES L. ENTWISTLE CO.

43 CHURCH STREET, PAWTUCKET, RHODE ISLAND

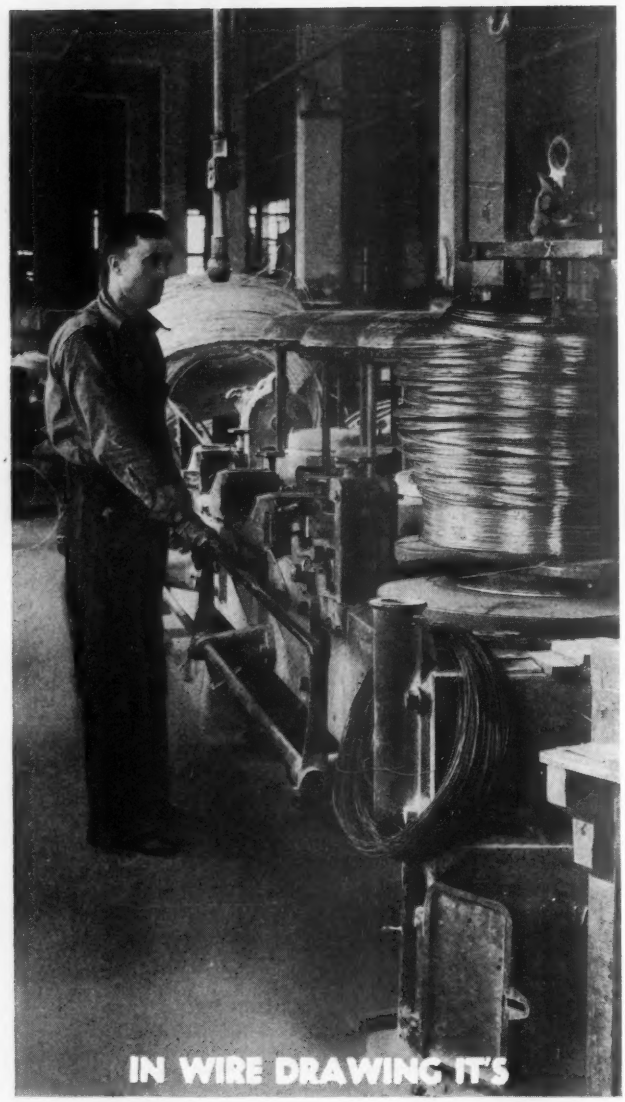
World's Leading Manufacturer of Spark-Testing Equipment

30 YEARS OF SERVICE TO THE WIRE INDUSTRY

Canadian Representatives:
THE A. R. WILLIAMS MACH. CO., LTD.
64 FRONT ST. W.
TORONTO, ONT.

British Associates:
GENERAL ENGINEERING CO., LTD.,
BURY ROAD, RADCLIFFE,
LANCS., ENGLAND

Limeless Wire Drawing with Metal Coat #267 Will Cut Your Overall Costs Per Ton of Wire Drawn by Worthwhile Margins!



IT isn't the elimination of the actual cost of liming and baking alone that cuts costs. There are many other definite improvements that are obtained when Magnus Metal Coat #267 is used.

Add up the total of the benefits listed below ... and you'll see why so many mills have standardized on this new method.

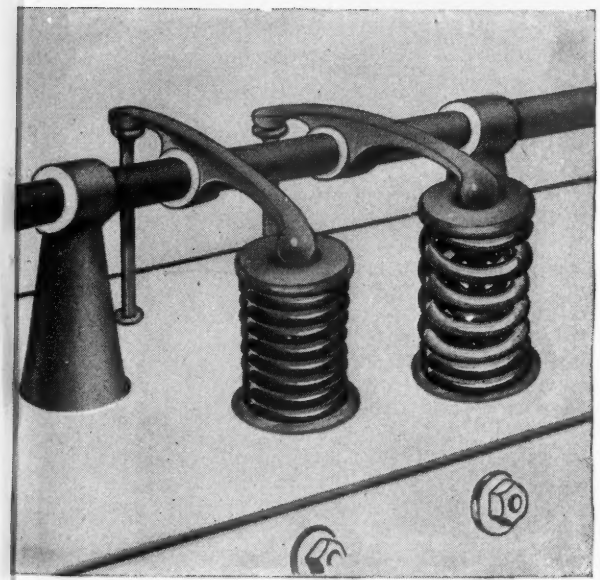
- Hydrogen embrittlement is eliminated right in the Metal Coat solution.
- Better rust-proofing is provided by Metal Coat #267 than by ordinary procedure.
- Die life is longer on any wire, but the improvement is particularly striking on high speed continuous operations.
- Rejects caused by off-size wire and by scratching are greatly reduced.
- Finish is far superior. This improved finish is particularly noticeable on bright wire. Rope, tire bead, and all wires produced for special finishes or coatings are also given a better finish than by ordinary methods.
- Less lubricant is always a factor in the savings made possible with Metal Coat #267. In many cases savings are in excess of 50%.
- Nor should the cleaner surroundings and machines and all around improved working conditions made possible by this new wire coating be overlooked.
- Yes . . . Magnus Metal Coat #267 costs more than lime . . . but you get better wire at a whole lot less per ton drawn.

Ask Us to Arrange for a Demonstration!

Magnus
CLEANERS • EQUIPMENT • METHODS

MAGNUS CHEMICAL COMPANY • 188 South Avenue, Garwood, N. J.
Service Representatives in Principal Cities
IN CANADA — MAGNUS CHEMICALS, LTD., 4040 RUE MASSON, MONTREAL 36, QUE.

Confidence- WITH ITS SLEEVES ROLLED UP!



YEAR BY YEAR, planes grow bigger . . . faster and safer. Man has unbounded confidence in his ability to build better and better planes. Never satisfied, he experiments and tests tirelessly, and aviation progresses.

With similar vision and confidence, Roebling has been pacemaker in the development and manufacture of products essential to the transportation and other industries. The active, widespread confidence it has won among technical men and operators throughout industry is Roebling's proudest asset. Look to Roebling for continued leadership . . . continual improvement in its products and engineering . . . continual progress.

ROUND WIRE THAT'S "FOUR SQUARE" ON THE JOB

YOU GET WHAT YOU WANT with Roebling Round Wire . . . dimensional accuracy . . . the right tensile strength, ductility and finish . . . fewer rejects. The uniform quality of Roebling Round Wire enables you to maintain an exacting standard for your product.

Meeting stringent specifications is all in the day's work with Roebling. From steel mill to shipment, every manufacturing process is positively controlled. Roebling plants and equipment are up-to-the-minute and unsurpassed. Workmen are trained in special Roebling methods and techniques developed through experience in wire making that is without an equal.

Your Roebling Field Man may be able to show you new ways of stepping up production and cutting costs with Roebling Round Wire. Simply call your nearest Roebling branch office.

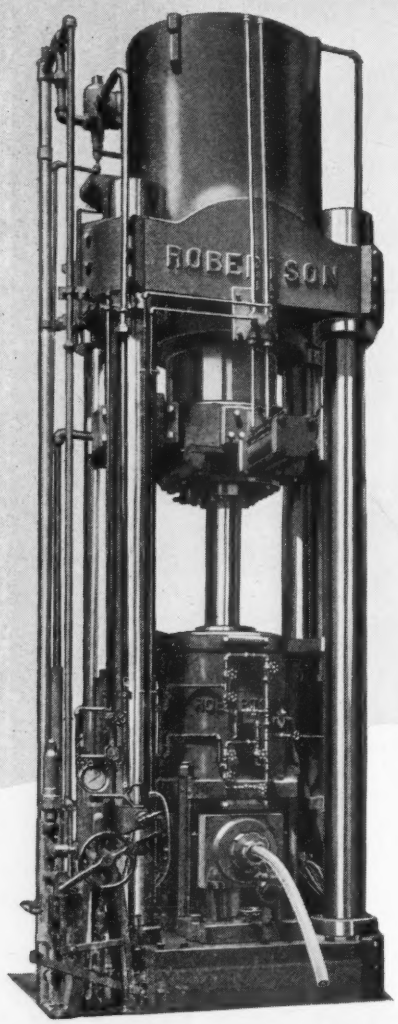
JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

A CENTURY OF CONFIDENCE ROEBLING

JR ROEBLING

★ WIRE ROPE AND STRAND ★ FITTINGS ★ SLINGS ★ SUSPENSION BRIDGES AND CABLES ★ AIRCORD, AIRCORD TERMINALS AND AIR CONTROLS ★ AERIAL WIRE ROPE SYSTEMS ★ ELECTRICAL WIRE AND CABLE ★ SKI LIFTS ★ HARD, ANNEALED OR TEMPERED HIGH AND LOW CARBON FINE AND SPECIALTY WIRE, FLAT WIRE, COLD ROLLED STRIP AND COLD ROLLED SPRING STEEL ★ SCREEN, HARDWARE AND INDUSTRIAL WIRE CLOTH ★ LAWN MOWERS

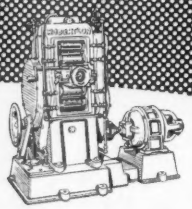
DOING ONE THING WELL FOR 89 YEARS



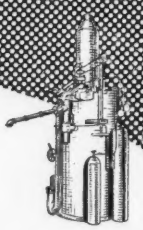
Cable Lead Encasing Press

For over 89 years, Robertson has specialized in the design and manufacture of *nothing but* high-pressure hydraulic equipment. A wealth of engineering experience and painstaking craftsmanship lie back of every piece of machinery produced. It follows, therefore, that a complete Robertson hose or cable lead encasing installation is engineered and "tailor-made" to accommodate the specific application for which it is intended.

Doing one thing well for over four generations carries a tremendous advantage in any field. This advantage is yours when you consult Robertson about your high-pressure hydraulic equipment.



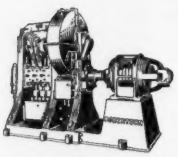
Lead Sheath Stripping Machine



Closed Lead Melting Pot

Robertson designs and builds all types of lead encasing machinery and hydraulic equipment including Extrusion Presses, Hydraulic Pumps, Metal Furnaces and Pots, Dies and Cores, Lead Sheath Stripping Machines and Special Equipment for Special Use.

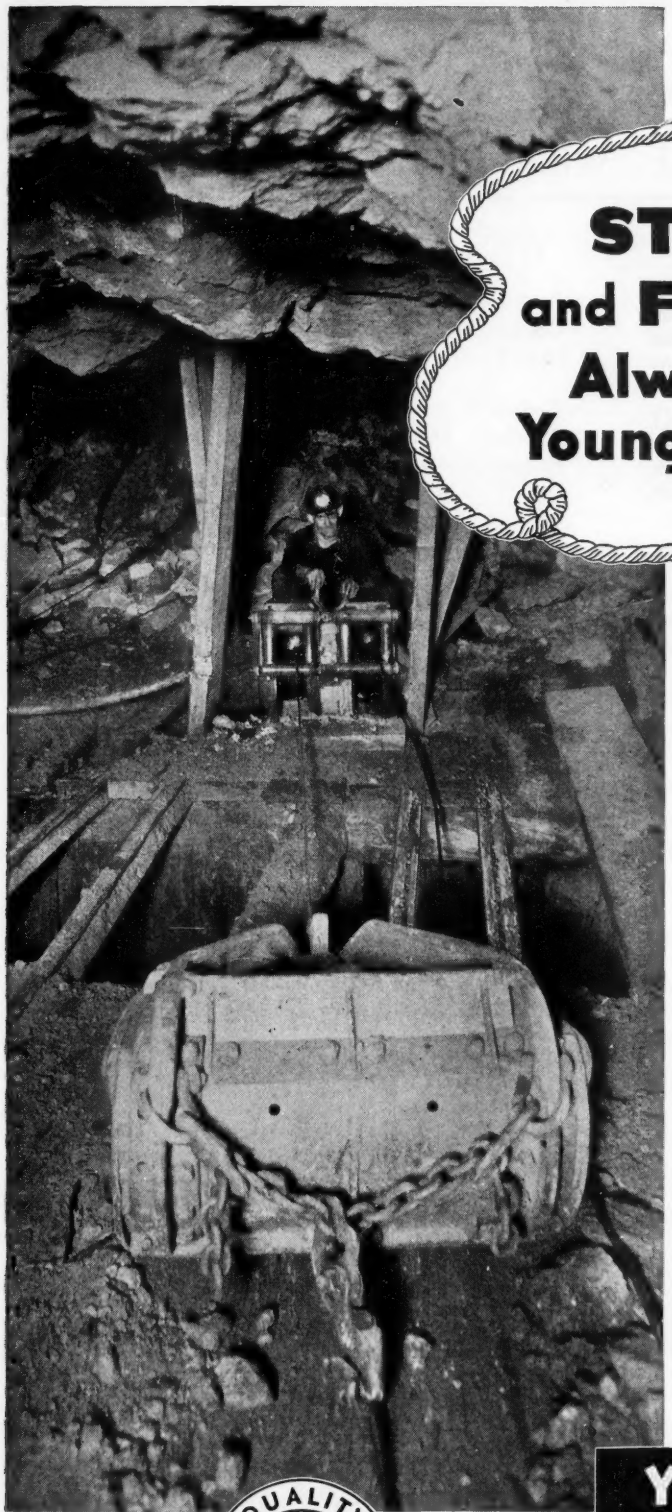
If you have any problem involving the maintenance, conversion, installation or repair of your encasing equipment, consult our engineering department. They'll be glad to help.



High Pressure Hydraulic Pump

JOHN **Robertson**
COMPANY INCORPORATED
125-137 WATER STREET, BROOKLYN 1, NEW YORK
Designers and Builders of all Types of Lead Encasing Machinery
Since 1858

If you would like to be among those receiving "Robertson Reminders," our occasionally-issued house-organ, write to us on your business stationery and we shall be glad to send you a copy, without obligation, of course.



STRENGTH and FLEXIBILITY Always "*Firsts*" in Youngstown RopeWire

Miles Under Ground

IN few industrial services can a cable break be more costly than in the remote reaches of underground mining--costly to repair or replace, costly to production, costly sometimes to human life.

Above all-below ground--wire rope must be strong and flexible, tough and corrosion resistant. These essential properties depend on the quality of the wire from which the rope is woven.

Specify Yolectro High Carbon Rope Wire and you can depend on it that your wire rope will have these wanted qualities and will keep them through a long lifetime of dependable service. Like all Youngstown wire mill products, Yolectro High Carbon Rope Wire is produced from the finest quality steel, refined, rolled and drawn to exacting specifications.

Photo by courtesy of the Preformed Wire Rope Information Bureau.

QUALITY TRADE MARK YOUNGSTOWN SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Bars-Rods-Wire-Cold Drawn Carbon Steel Rounds-Electrolytic Tin Plate-Coke Tin Plate-Pipe and Tubular Products - Sheets - Plates - Conduit - Tie Plates and Spikes.

HUDSON WIRE COMPANY

PRODUCERS OF FINE WIRES IN ALL METALS

FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

Cadmium, Nickel Silver (10%, 18%, 30%), Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloys, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity Electric Wire.

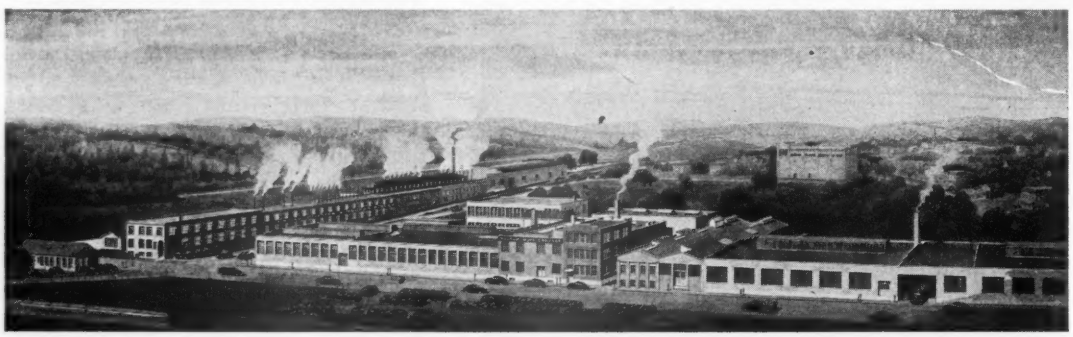
Cadmium, Nickel Silver (10%, 18% 30%), Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

Look for the name — **HUD CO** — A guarantee of quality

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Write for Prices and Samples • Let Us Quote on Your Requirements

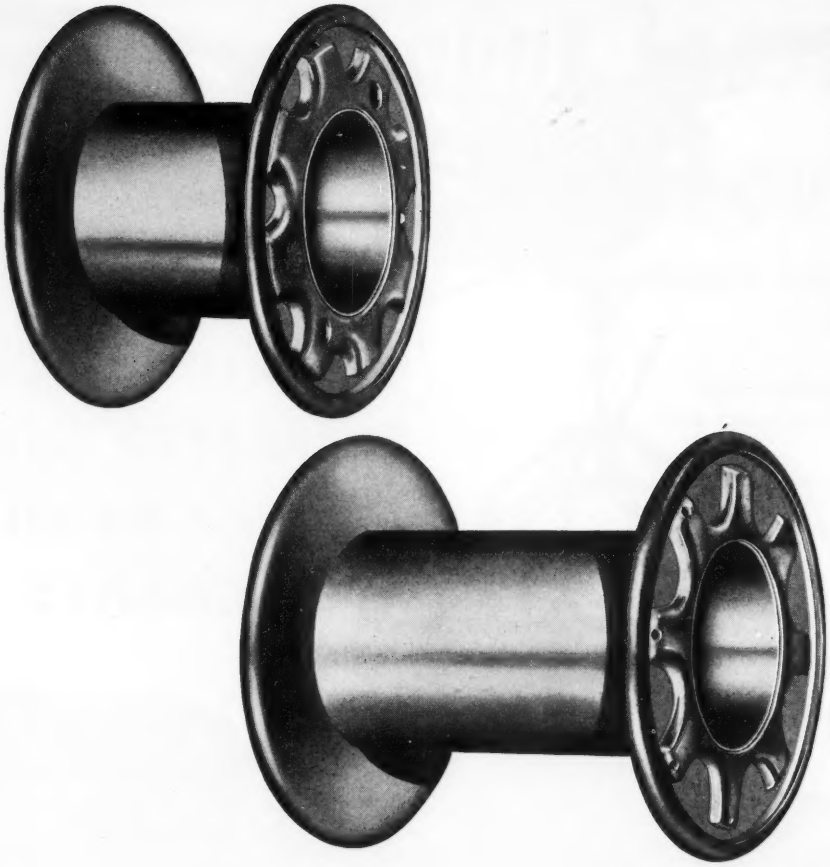


"HUDCO" PLANT AT OSSINING, NEW YORK

HUDSON WIRE COMPANY

Established in 1902 — Successors to Royle & Akin

OSSINING, NEW YORK



new type

HEAVY DUTY
HUBBARD STEEL SPOOLS

for wire drawing and processing.....

New steel washer design* provides greater strength and rigidity than ever before available. These new Hubbard HEAVY DUTY Spools are made with heavy gauge steel to withstand impact and abuse . . . and to hold accuracy in dimensions no matter how used. All joints are brazed and finished smooth . . . to provide and maintain tight joints so wire cannot be trapped.

These new heavy duty spools are recommended for all types of wire drawing and processing . . . and are particularly recommended for handling fine wire. Exact spool balance assures efficient performance at new high speeds. Write for information . . . built in all standard sizes.

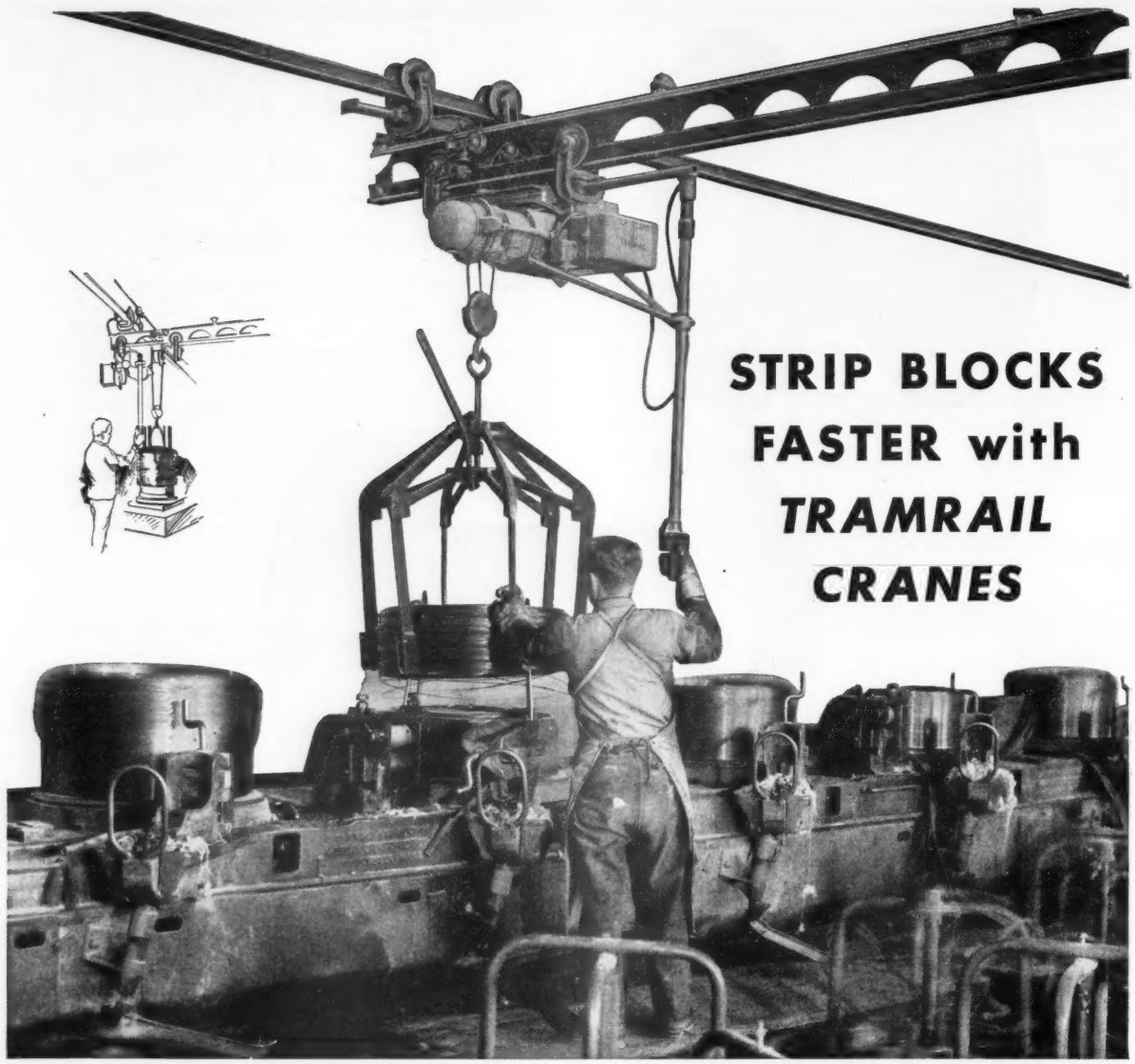
HUBBARD SPOOL COMPANY

1624 CARROLL AVENUE • CHICAGO 12, ILLINOIS

Hubbard

STEEL SPOOLS AND REELS . . . METAL BOUND
SPOOLS AND REELS . . . STEEL TRAVERSES
LIGHT WEIGHT REELS . . . WOOD REELS

*patent pending



STRIP BLOCKS FASTER with *TRAMRAIL* CRANES

Efficiency is greatly improved when Cleveland Tramrail block-stripping cranes and carriers are provided for handling rod and wire at drawing machines. Time of both men and machines is used more effectively. Since the overhead equipment enables the workers to strip the blocks easier and faster, there is less "down" time for the machines and more wire can be drawn per day.

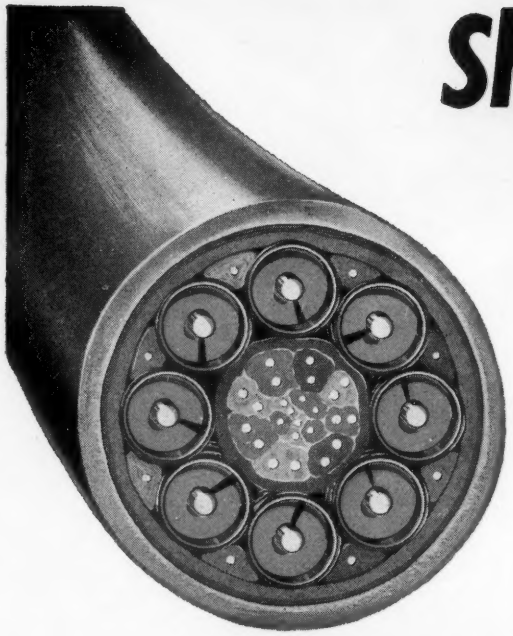
Not only do Tramrail cranes cut costs, but they eliminate need of workers making heavy lifts, thereby reducing hernia injuries and aiding safety. Large numbers of Cleveland Tramrail block-stripping cranes and carriers have been in service in various wire and rod plants for many years.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
9207 EAST 288th ST. *WICKLIFFE, OHIO*

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT



Shunt Losses Cut About 92%

in telephone coaxial cable

DU PONT POLYTHENE

minimizes power losses in high-frequency signal transmission

For the Bell System's construction program, Western Electric is producing thousands of miles of coaxial cable, much of it using insulation discs of Du Pont polythene in the coaxial units—as many as 506,000 discs per mile in a typical cable.

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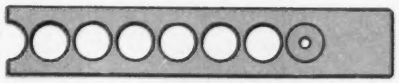
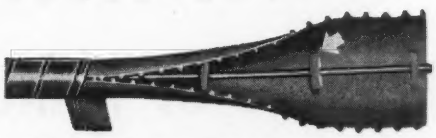
HOW POLYTHENE IS USED FOR COAXIAL UNIT INSULATION



Discs measuring approximately ⅜" O.D. are punched from sheet polythene. Centers are also punched to fit center conductor.

Polythene insulating discs are then slit from perimeter to center to permit them to be assembled on the inner conductor.

Discs are mounted on copper inner conductor wire. Polythene permits easy installation, yet doesn't buckle under stress.



Outer conductor of copper tape is formed into tube around inner conductor and bound with steel tape, forming completed coaxial unit.

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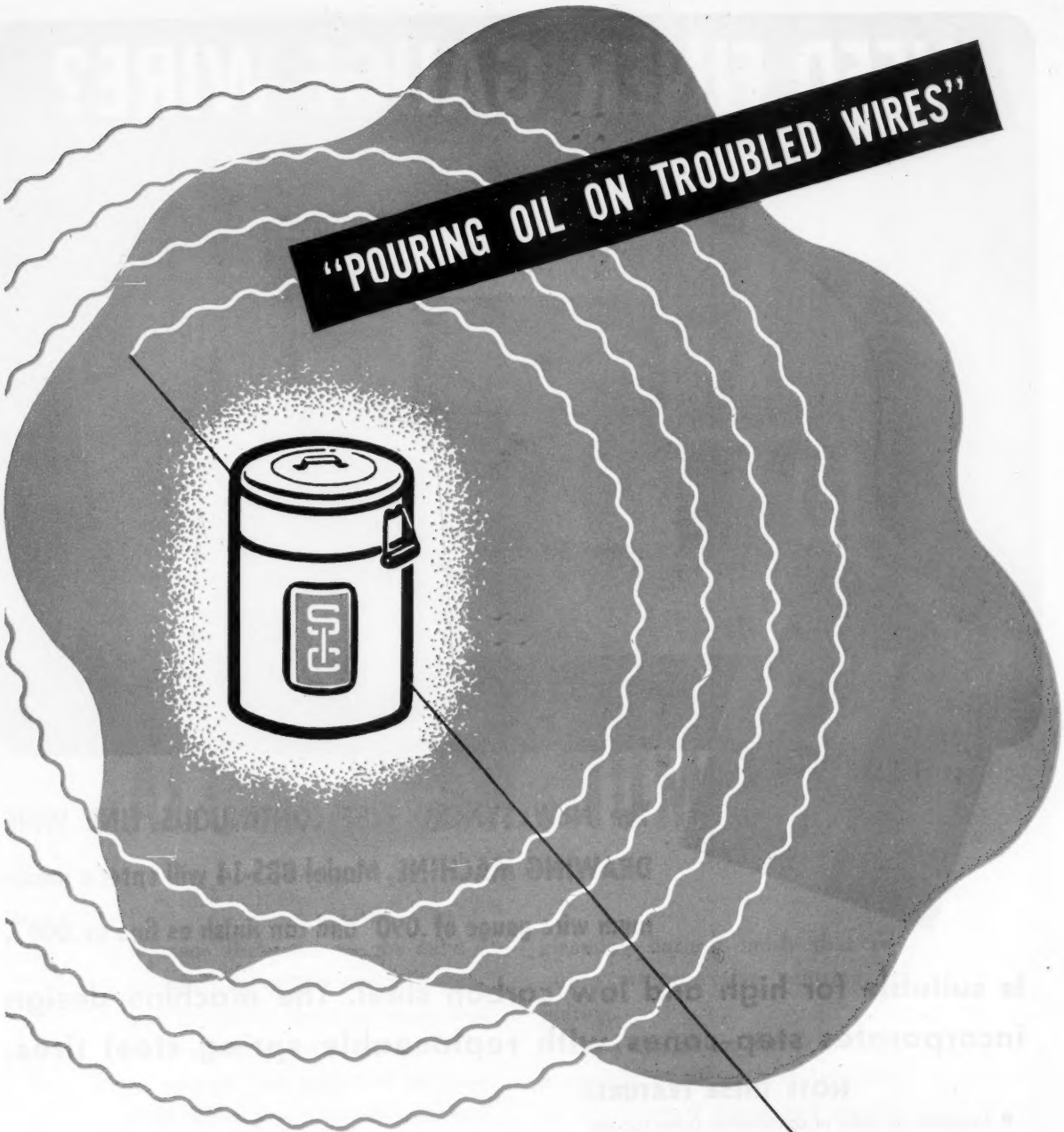

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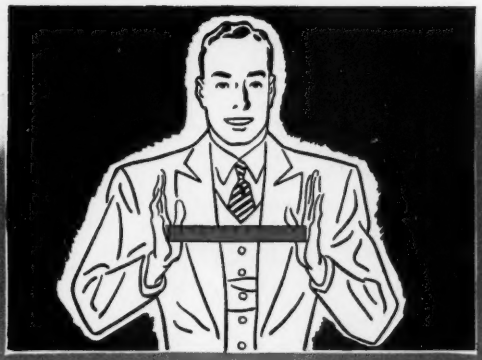

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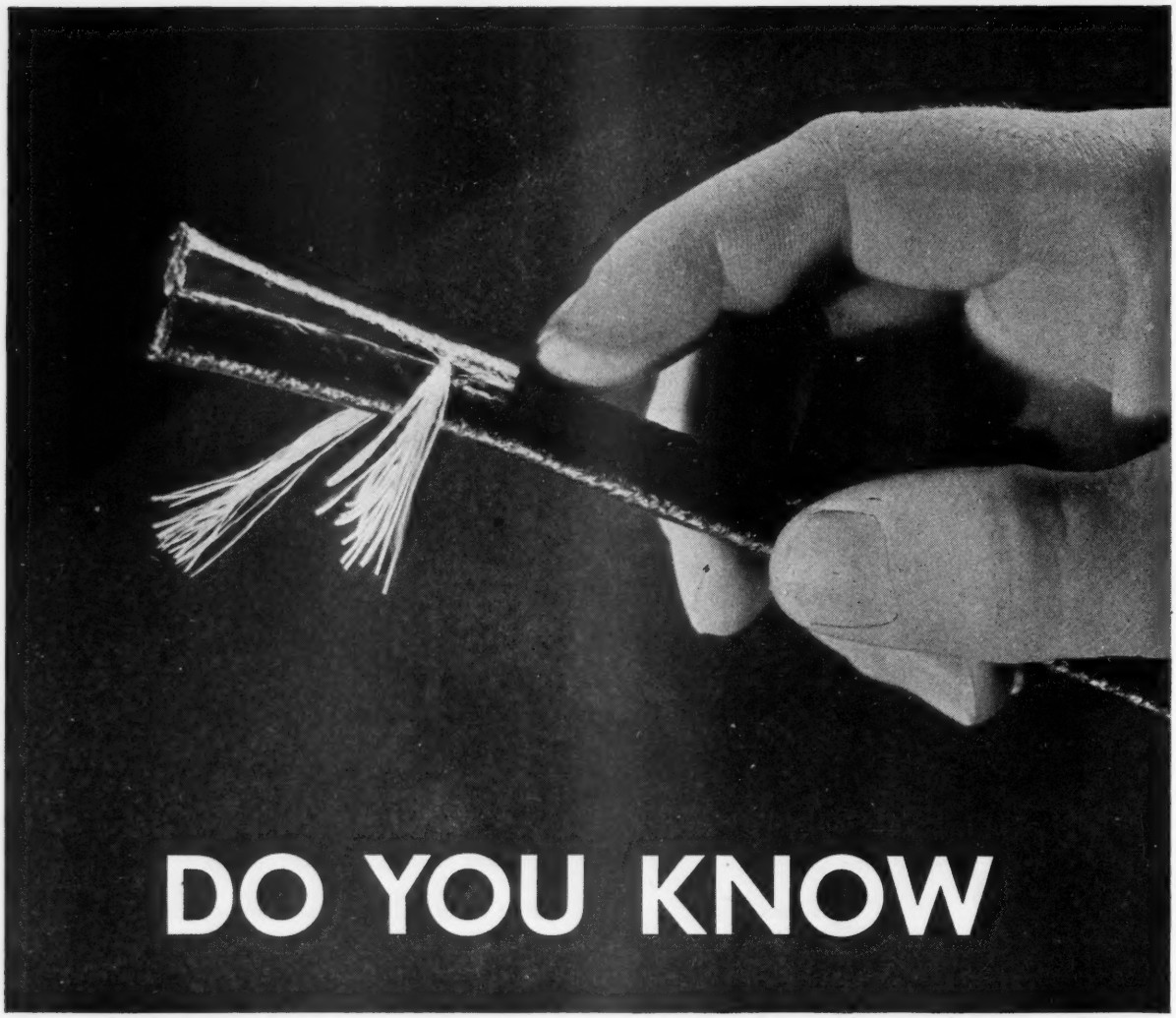

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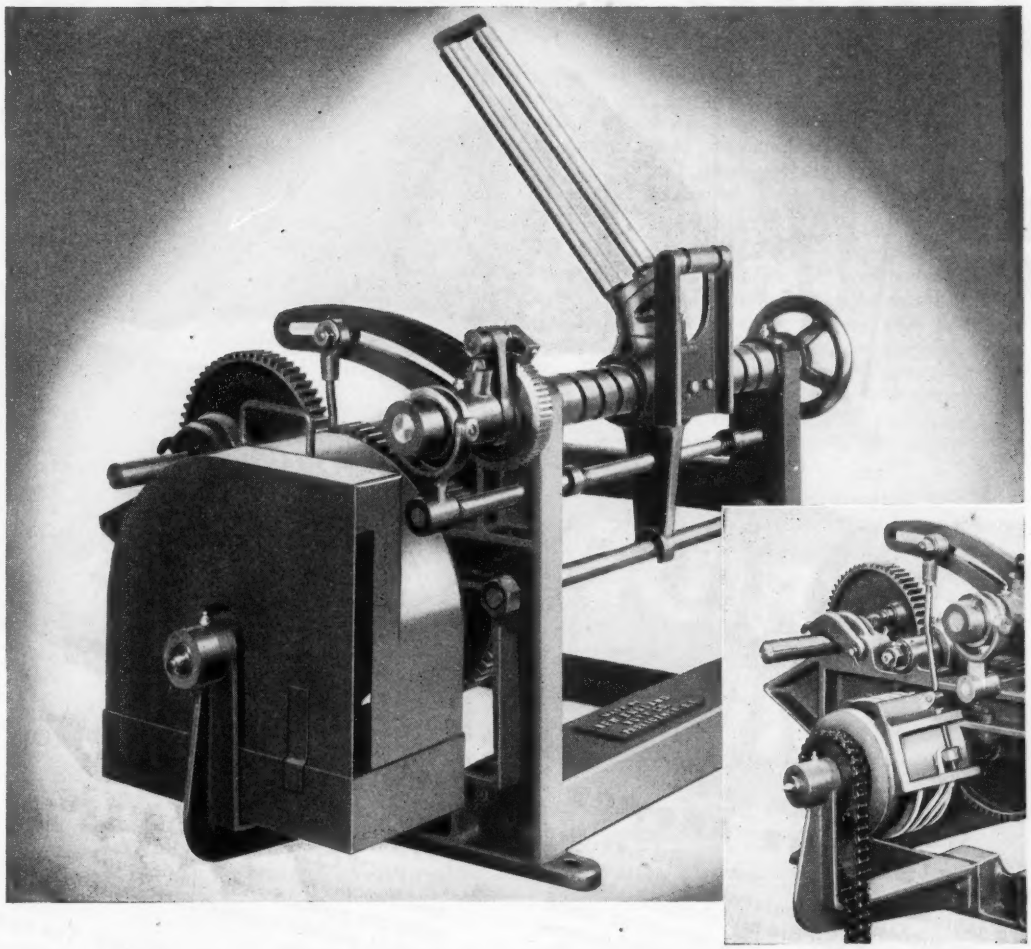

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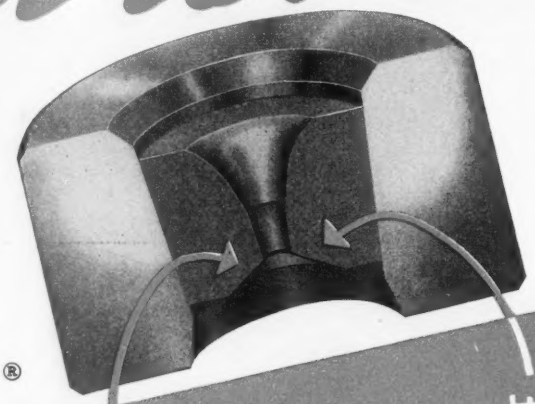

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The Wire Outlook

February's slump in commodity prices is a splendid example of the result of Government meddling with the natural law of supply and demand. Prices maintained a long steady climb as long as the Government purchased large quantities of staple produce and created, in the process, shortages that would not otherwise have existed. When quotas were filled, or approximately so, and its purchases tapered off, the effect was quickly felt and prices tended to readjust themselves to healthier and more normal levels.

In this readjustment there should be nothing alarming, but it again strongly indicates the desirability of our Government's getting out of the business of accumulating supplies for the purpose of maintaining prices — in fact, of getting out of the business of competing with private enterprise altogether. A recent report showed that the Federal Government, through bureaus, owns and operates forty-five big corporations, involving a capital of some $30,000,000,000. This alarming concentration of financial power in the hands of bureaus in competition with private enterprise is another "New Deal" faux pas, to which Congress would do well to put a stop. It can, and save taxpayers many billions, if it dried up the appropriations that support our power-greedy bureaus.

It seems trite to repeat that it is essential that a public, heavily burdened by war-time taxes, requires and should have relief. It can be done only by curtailing the enormous demands made upon the Treasury by bureaus that we would be better off without.

Scrap remains the Number One problem of the steel mills. Were users of steel to dispose of their scrap, getting it back to the mills promptly, it would help. It is interesting to note that the dismantling of Japanese war plants, fortifications and fleet have built up a stock of seven million tons of scrap there. It might be desirable to get some or all of this into our hands quickly. However, renewed activity to make available the scrap that is available in this country is being urged on all sides.

Over-all business continues at high levels, with no prospect or reason for abatement. The wire industry is no exception, although, as for some time, the non-integrated mills are operating on a hand-to-mouth basis, getting only a fraction of their requirements, except for non-ferrous alloys, where the supply appears to be reasonably adequate.

Merchant wire for farm construction and rehabilitation has remained high in spite of the severe winter. Jobbers are calling vigorously for more and more barbed wire, fencing, nails and staples.

Bolt and nut manufacturers report heavy demand for small sizes, with four month backlogs on larger sizes. There is little change in the demand or supply pattern for steel rods, wire or wire products. A general rise in the price of nails and fence items took place without upsetting any applecarts.

Constantly widening increases in the uses of aluminum have tended to stabilize the metals market, removing pressures on many metals that would otherwise be more acute. In spite of the high production levels of aluminum, as compared with pre-war production, the urgency of current demand indicates a high level of operations for the aluminum industry for some time to come.

Lead production is reported to be rising, but the demand continues to exceed available supplies.

Some copper producers believe that increasing production and imports are expected to make a gradually improving supply available.

The zinc market reflects an active demand for all grades, Prime Western, Special High Grade and High Grade being the most difficult to secure in adequate quantities.

It is always unfortunate that election-year politics are permitted to becloud the issues that require a sane and non-partisan approach to solutions, but this being one and politicians being what they are, we shall have to muddle through and hope for a modicum of wisdom on the part of those who occupy seats of responsibility in the period that ensues, to offset the current confusion.

—from the Editor's Desk

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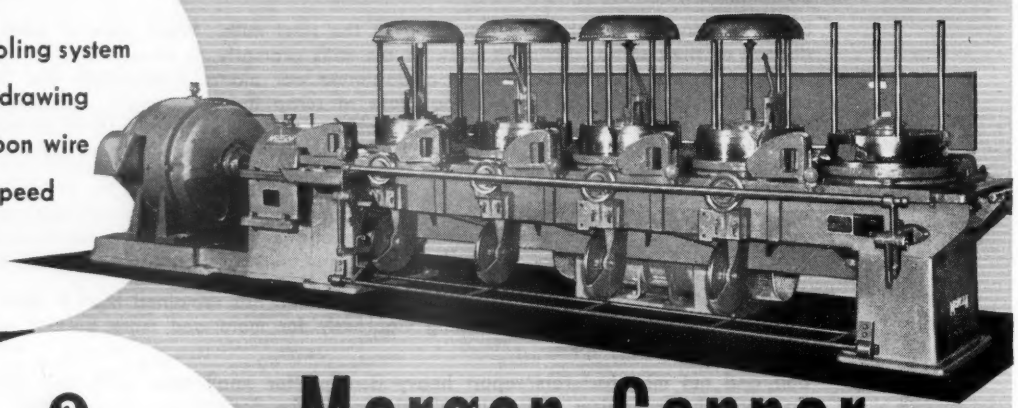

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 23 MARCH, 1948 No. 3

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Contents

Electrical Applications in the Wire Industry
by J. G. Roby 213

Corrosion Inhibitors in Theory and Practice
by Robert D. Misch
and Hugh J. McDonald 221

Portsmouth Steel Corporation — The Earliest of the Modern Wire Mills—
by Kenneth B. Lewis 227

Labor Relations
by John B. Stone 234

Government Wire Production Information 235

Outstanding Personalities of the Wire Industry 240

A Review of Recent Wire Patents 247

Index to Advertisers 267

Where-to-Buy 268-272

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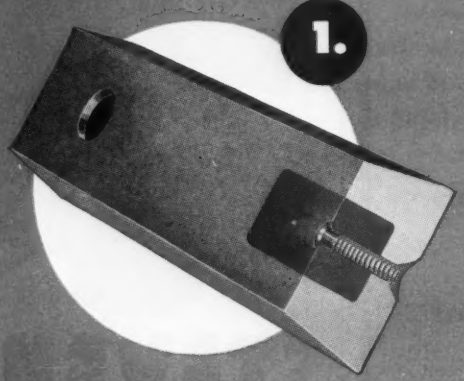

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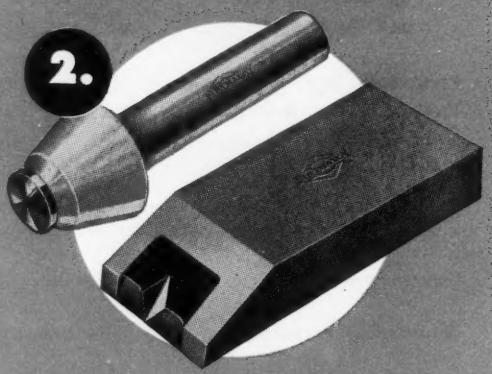

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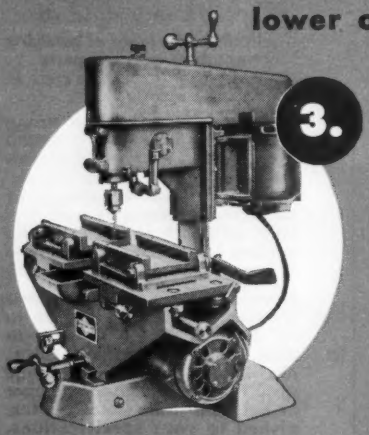

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WIRE
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A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 23 MARCH, 1948 No. 3

Electrical Applications in the Wire Industry

J. G. Roby

Machinery Division
Industrial Engineering Divisions
General Electric Company
Schenectady, N. Y.

A discussion of the different types of wire drawing machines and the electrical drives for each.

A complete discussion of all the electrical equipment used in the wire industry would be too extensive to undertake in an article of this length. In addition, some of the interesting electrical applications which space limitations will not permit discussing are in the following phases of the wire industry:

(a) **Processing lines such as patenting, annealing, tinning, plating and cleaning.**
(b) **Wire insulating machines such as enameling machines, extruding machines, taping machines, pulp insulating machines, and braiding machines.**
(c) **Wire and cable machinery such as stranding machines, cabling machines, cable sheathing machines, including lead presses, and cable testing machines.**
(d) **Wire product machinery such as wire fence machines and machines to make innumerable wire products.**
(e) **Auxiliary equipment for drawing and handling wire, including reel drives.**

* * *

THIS article will cover only a small, but certainly basic portion of the wire industry: drawing the wire itself. During the past thousand years wire has been manufactured by drawing it through a die, but the progress of the art was very slow until the advent of electrical drives. In recent years, due to the evergrowing use of electricity in the industry, great improvements have been made in both speed and quality of wire drawn.

BASICALLY, a wire drawing machine consists of a die with means for applying lubricants to the rod before it enters the die, and a power driven drum which acts as a capstan to draw the wire through the die, and which very often provides storage for the drawn wire. If the capstan provides storage for the drawn wire, it is known in the trade as a "block". A complete wire drawing machine may consist of several dies with their related capstans or blocks, the number being dependent, among other things, on the number of passes through the dies that the wire is able to make before annealing.

* * *

Reasons for Different Electrical Drives

THERE are different types of wire drawing machines and for a given type there may be different electrical drives. The type of electrical drive depends primarily upon cost, power supply, production requirements which dictate the amount of flexibilty required, and the type of operation of the machine itself. To illustrate the latter point, there is a basic difference between a steel wire drawing machine and a nonferrous wire drawing machine. For steel wire it is important that there be no slippage between the wire and the capstan because slippage would tend to groove the capstan, would "burn" the wire, and would wear off the lubricant which is on the wire, resulting in more difficult drawing and increased die wear. For soft metal such as copper and aluminum, slippage can be tolerated because it does not tend to groove the capstan, and these wires are deluged with lubricant during the drawing process.

* * *

IT is the purpose of this article to discuss the different types of wire drawing machines and the electrical drives for each.

* * *

Types of Wire Drawing Machines

WIRE drawing machines fall into four general types: They are:

(a) **Single-block, group driven.**
(b) **Single-block, individually driven.**
(c) **Multiple block with single-motor drive.**

(d) Multiple block with each block motorized.

THE group-driven single block is an old method and has been outmoded. It consisted of single blocks, several of them, all driven through suitable gearing by a single motor, with an arrangement to clutch or declutch from the main drive shaft. Their disadvantages were many and the industry has wisely decided to eliminate this type of drive on new equipment.

* * *

Individually Driven Single Blocks

THE individually driven single block has taken over this type of application and Fig. 1 shows a typical installation of a machine of this type. These machines are built for either single or double passes and the illustration shows one of the double pass type. The rod, or wire, passes through the tangle switch, through the first die, takes a few turns around the underdeck of the double-deck block, around the idler pulley, through the second die and to the top deck of the block, where it is coiled up. This top-deck block has an upward taper so that the wire coming from the die is wound at the point of maximum diameter and successive wraps force the preceding ones up the tapered portion and finally on to the skeleton portion of the block. For a single pass machine the bottom deck and second die are omitted.

* * *

A machine of this type is used for all kinds of wire where a maximum flexibility is desired.

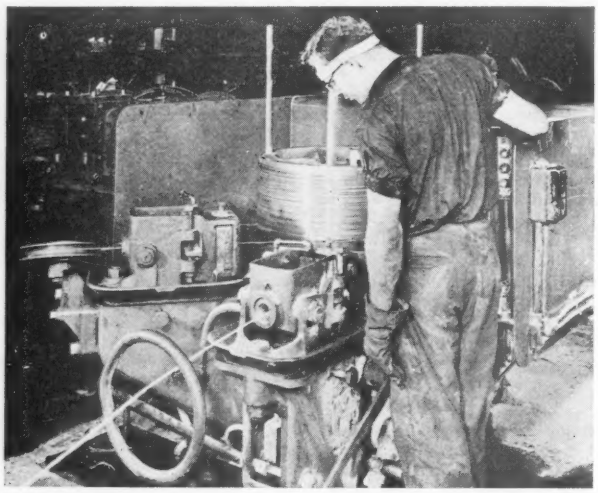

Fig. 1 — Sinble block, double pass wire drawing machine with individual motor drive. (Courtesy Vaughn Mach. Co.) * * * * * *

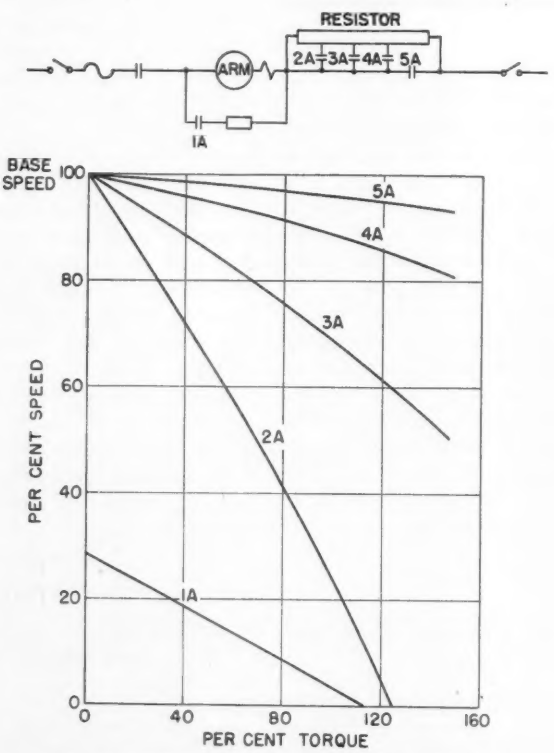

Fig. 2 — Jogging and starting characteristics for constant potential d-c drive. * * * * *

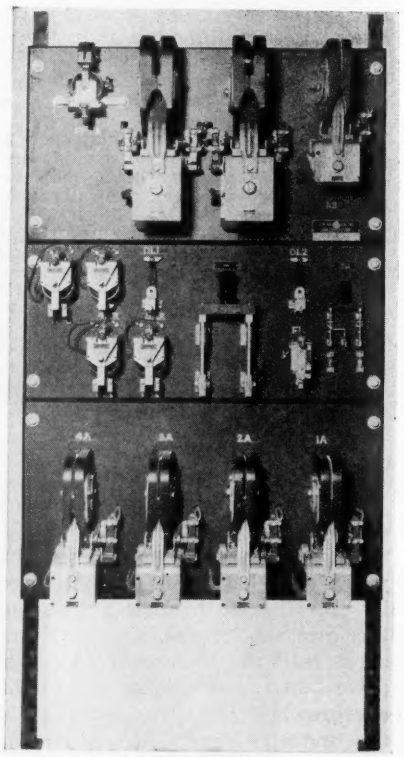

Fig. 3 — Constant potential d-c control panel for adjustable speed d-c motor. *

THE main operating requirements of a machine of this type are as follows:

(a) Adjustable drawing speed for maximum production of a given size of wire.
(b) Slow starting and smooth acceleration in order to minimize wire breakage.
(c) Rapid acceleration for maximum production.
(d) Low jogging speed in forward direction to facilitate threading the machine.
(e) Low jogging speed in reverse direction to permit ease of stripping finished coil from block.
(f) Braking to rest after jogging in either direction to facilitate spotting of block.
(g) Rapid stopping.
(h) Adequate safety devices.

* * *

DIFFERENT types of a-c drives have been used but by far the most flexible arrangement can be had with a d-c drive. A multi-speed induction motor may provide an adjustable-speed range but the starting is not smooth. A wound-rotor induction motor can provide smooth starting but the draw speed is not adjustable.

* * *

A d-c drive is a "natural" for this application because of its flexibility. Where d-c power is available, a constant potential, adjustable speed d-c drive is recommended. This type of drive will provide an adjustable speed over a speed range up to 6 to 1, if desired, and will meet all of the other requirements. The low jogging speeds are obtained by a shunted armature connection. Acceleration is by cutting out sections of the armature resistance. The speed-torque characteristic is as shown in Fig. 2; curve 1A is for the shunted armature connection, and the other four curves are for the different values of armature resistance. The slopes of the different curves may be changed for different values of armature or shunt resistance. More than one armature shunted connection can be obtained if desired. Fig. 3 illustrates a control panel for such a drive. The resistors, which are not shown, are mounted separately.

FOR installations where no d-c power supply is available or where a range of speed control is desired which is greater than that possible with field control, the adjustable voltage (Ward-Leonard) drive should be used. This type

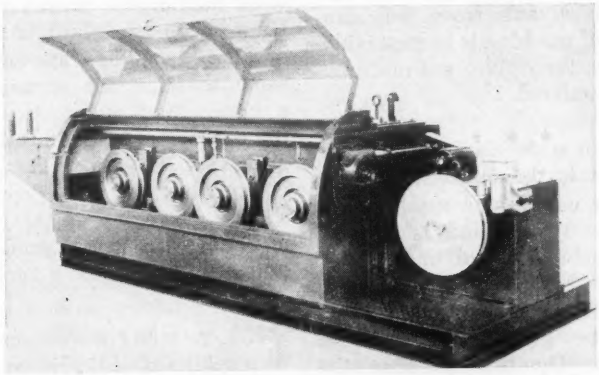

Fig. 4 — Multiple block wire drawing machine with single motor drive cone tandem machine. (Courtesy Syncro Mach. Co.) * * * *

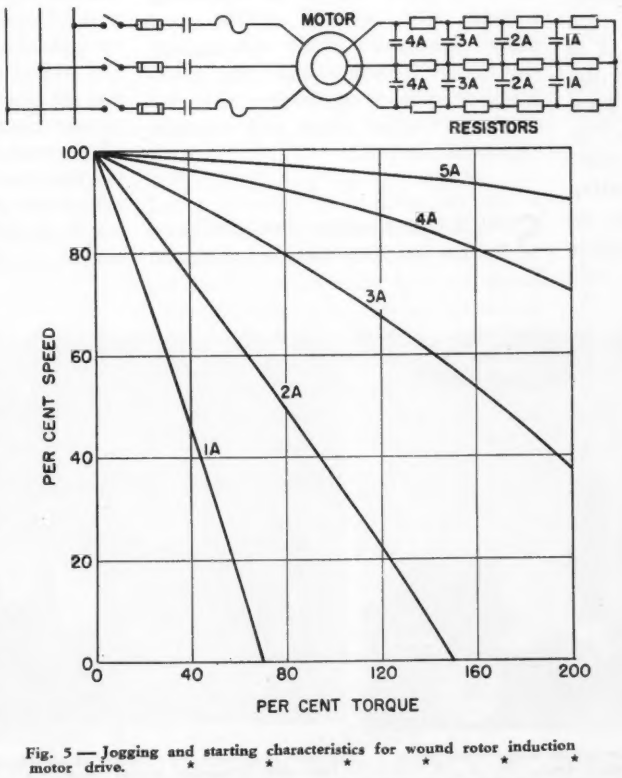

Fig. 5 — Jogging and starting characteristics for wound rotor induction motor drive. * * * * * *

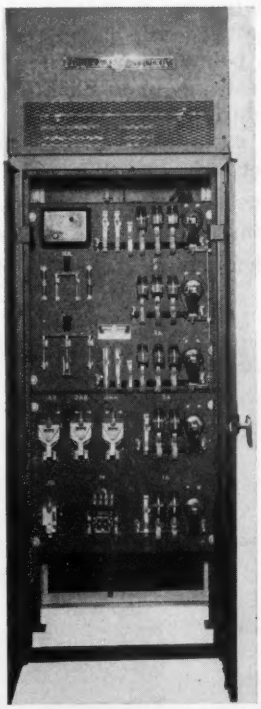

Fig. 6 — Magnetic, non-reversing, plugging control panel for wound rotor induction motor. * * *

of drive is the best from an operating standpoint but is slightly more expensive than the constant-potential adjustable-speed d.c. drive.

* * *

Multiple Block With Single Motor Drive Tandem for Non-ferrous Wire

THERE are several types of multiple-block machines with single motor drives, and since this general type of machine is in most widespread use, three different machines will be discussed.

* * *

THE first is the multi-block cone tandem continuous machine for non-ferrous metals and is typified by the machine shown in Fig. #4. This particular machine has 11 dies and 11 capstans with all of the capstans being gear driven from one motor. On this machine the wire is brought through the die, given several wraps around the capstan, and is then passed directly to the next die and so on until the last block or reel is reached. Thus this type of machine is strictly continuous in that the wire passes through each die at the same rate in pounds per minute. Since it is practically impossible to arrange the reduction of each die and the speed of each drum exactly to the correct value, machines of this type are laid out to have over-feeding from one capstan to the next. In other words, the speed of the first capstan is relatively higher than that of the second, and so on. This causes slippage of a few per cent on all except the final capstan, since a capstan can only draw wire through the die preceding it.

* * *

IN Fig. #4 the final capstan is shown at the right and the other ten capstans are located on the four shafts shown inside the machine, with the largest diameter capstans being located on the front with one or more smaller capstans on the same shaft in the arrangement of a cone, thus giving this machine the name of a cone-tandem machine. Following the last capstan, the wire is wound up on a reel, which is not shown. Machines of this type also are built with a final winding block, or coiler, instead of a reel.

* * *

THE operating requirements for a machine of this type are, in general, not as stiff as for the single block machine. The reason for this is that this machine does not need to be nearly as flexible as the former since, ordinarily, it is a "one job" machine and does not need to cover a wide range of operating speeds. Although all of the operating features listed previously would be desirable, the only absolutely necessary operating requirement is a slow start and smooth, rapid acceleration.

* * *

SINCE this machine does not have to be so flexible, a constant speed motor is permissible in a majority of cases. This immediately opens the door to an a-c drive. A few squirrel-cage induction motors have been used but in general the starting is not smooth enough to be very desirable. Some synchronous motors have been used with the same objection. A further objection to synchronous motors is that they are not very suitable for the severe jogging service to which a machine of this type is subjected. The advantage of the synchronous motor in that it offers power-factor correction is offset by these disadvantages.

* * *

ALTHOUGH d-c drives of both the constant potential and Ward-Leonard type can be and have been used, the economics of the system in general point toward using a wound rotor induction motor. A wound rotor induction motor drive has a relatively low cost since it operates from the a-c line, and very often from high voltage a-c, and has a very definite advantage over a squirrel cage motor in that it offers smooth starting. Fig. #5 shows a typical power circuit and speed-torque characteristics for a wound rotor induction motor for service of this type. This shows how the armature resistors are shorted out in four steps with the speed torque characteristics for each step of resistance. Curve 1A corresponds to the condition with all of the armature resistance in and is the curve on which most of the jogging service is accomplished. Curves 2A,

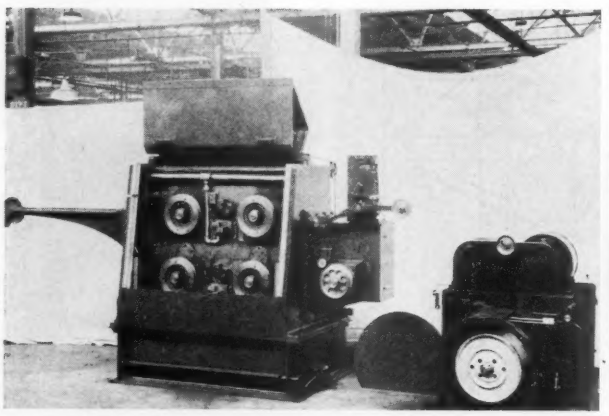

Fig. 7 — Multiple block wire drawing machine with single motor drive. Upright cone machine. (Courtesy Syncro Mach. Co.) * * * *

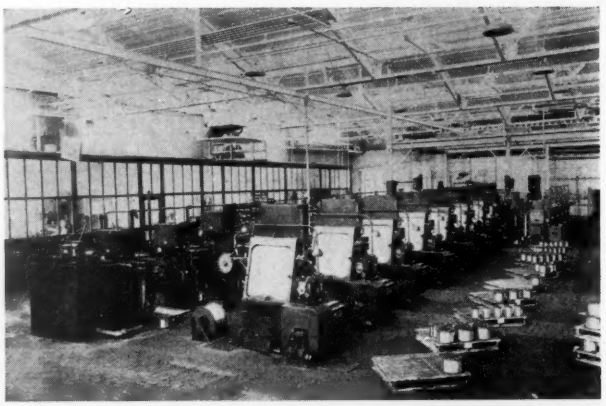

Fig. 8 — Installation of a battery of upright cone machines for drawing fine wire. (Courtesy Syncro Mach. Co.) * * * * * *

3A, and 4A are for successive values of shorted resistance and curve 5A is for the shorted secondary. During acceleration the motor torque is adjusted from one curve to the next higher as the resistance is shorted out. Fig. #6 shows a typical control panel for a drive of this type. The starting resistors are mounted in a ventilated enclosure on top of the panel.

* * *

Upright Cone Machine

ANOTHER type of wire drawing machine which is in the same family as the machine just described but of a little different design is the uprght cone machine. This type of machine is used for drawing medium and fine wire. Fig. #7 illustrates a machine of this type and shows the arrangement of the capstans and dies. This type of machine, also, is very often built with a final winding block, or coiler, instead of the reel as shown in the illustration. This particular machine is followed by a reel which is driven by a constant speed a-c motor through a magnetic slip clutch. The excitaton on the magnetic-clutch, and the resulting wire tension, is controlled by a dancer roll which operates a voltage regulator to control the clutch excitation. Complete electrical drives for the spooler have also been developed and put into successful operation, but since it is not intended that this article should cover reel drives, which is a subject in itself, this portion of the wire drawing machine will not be discussed.

* * *

IN general the operating requirements for this type of machine are identical with the cone tandem machine just described, with the exception that in the machines for drawing extremely fine wire, smooth starting is not quite so important because those machines are operated with light tensions and lots of slip on the capstans. Fig #8 is a typical installation of a battery of machines for drawing fine wire. On the machines shown at the far right of the photograph, wire is drawn to sizes as small as .001″ diameter. For fine wire drawing machines of this type, multi-speed squirrel-cage motor drives have been found successful as long as starting is made first on the low speed step in order to give a step start. For the larger machines, as illustrated by Fig. 7, where smooth starting is important and low jogging speeds are necessary, wound rotor induction motors have proved to be the most practical. Some d-c drives have been used, however, and perhaps the most interesting one was an application of Thy-mo-trol drive which is now in operation on a machine of this type.

* * *

Thy-mo-trol Drive

THE machine is driven by a 40-hp d-c motor with the d-c power being supplied by a rectifier consisting of three sealed ignitrons. Fig. #9 shows the power circuit of the Thy-mo-trol drive with the firing and control circuits shown schematically. The unique firing circuit is shown in Fig. #10. In order to obtain low motor currents it is necessary to use a separate excitation firing system of the stored energy type, rather than the anode firing circuit ordinarily used on most ignitron applications. The capacitor, 10C, is charged on alternate half cycles by current flowing through the phanotron. The capacitor then discharges through the thyratron to supply the ignitron current. The grid of the thyratron is controlled by vacuum tube circuits, (not shown) to regulate the firing current. A holding circuit is formed by the phanotron, tube 10, which introduces a dummy load to maintain the cathode spot at those times when the motor currents being drawn are too light to maintain the spot. The remainder of the control circuits provide regular Thymotrol functions, including current limit and IR drop compensation. Fig #11 is a front view of the Thy-mo-trol panel showing the firing thyratrons, charging and holding phanotrons, field phanotrons and control tubes. Fig #12 is a back view of the same panel and shows the three ignitrons and the control circuit components.

* * *

THE advantages of the Thy-mo-trol drive are as follows:

(a) Operates from a-c power.
(b) Stepless speed control over an extremely wide range.
(c) Preset speed.
(d) IR compensation providing an adjustment of speed regulation.
(e) Low jogging speed which is independent of motor load.
(f) Adjustable current limit which provides smooth acceleration at a maximum rate.
(g) Speed control from remote location and from more than one location if desired.
(h) Easily installed, and can be installed in any convenient location.
(j) High operating efficiency and low maintenance expense.

* * *

Non-slip Storage Type for Steel Wire

A third type of multiple block machine with single motor drive is the "Connor" type of machine which is used primarily for drawing steel wire. The basic purpose of this design is to eliminate any slip of the wire on the blocks. This is accomplished by allowing each block to accumulate a storage of wire and then have the wire uncoiled as required by the succeeding block.

* * *

FIG. 13 illustrates a machine of this type. After the wire comes from the die, a number of turns are taken on the block to form a reservoir of wire. Then the end of the loose coil on the block is passed down through the center of the block, around idlers to the next die, and then on to the next block. Thus if the first block is drawing wire at a greater speed than the next block is taking it away, the excess wire accumulates on the block but no slippage occurs.

* * *

BESIDES eliminating slip, another advantage of the storage principle is that it allows the wire time to cool while it is stored on the block, thus increasing the life of the dies and maintainng the physical properties of the wire. For this latter reasen this machine is particularly useful for drawing high carbon wire.

* * *

THESE machines are driven by a single motor and the gearing for the different blocks is arranged so that there is a slight overfeeding between dies such that each block

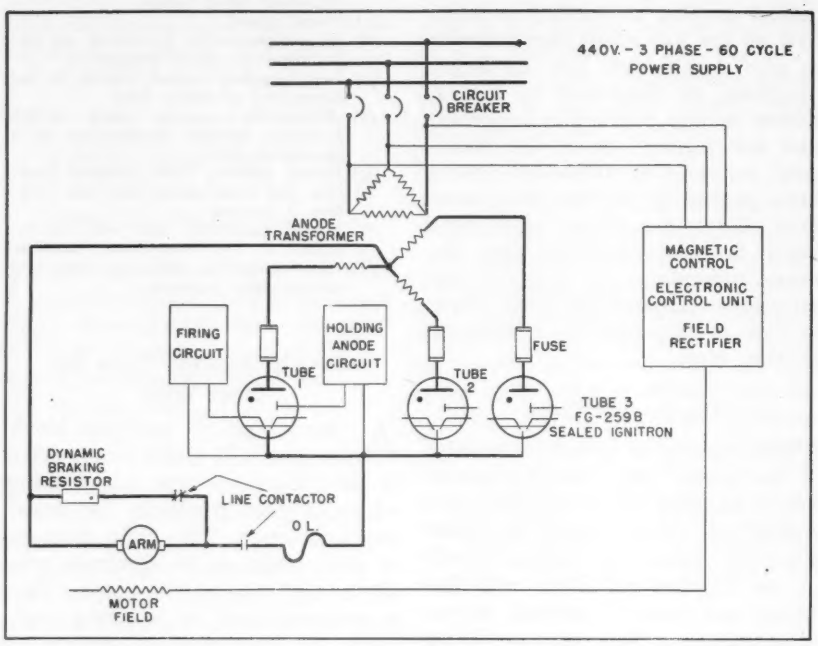

Fig. 9 — Power circuit for 40-hp Thy-mo-trol used on wire drawing machine. * * * * *

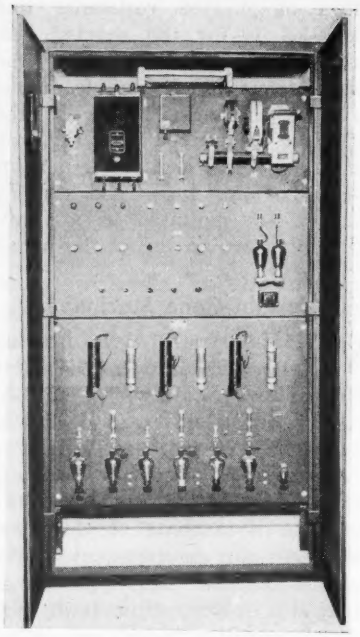

Fig. 11 — Front view of Thy-mo-trol panel. * * * * *

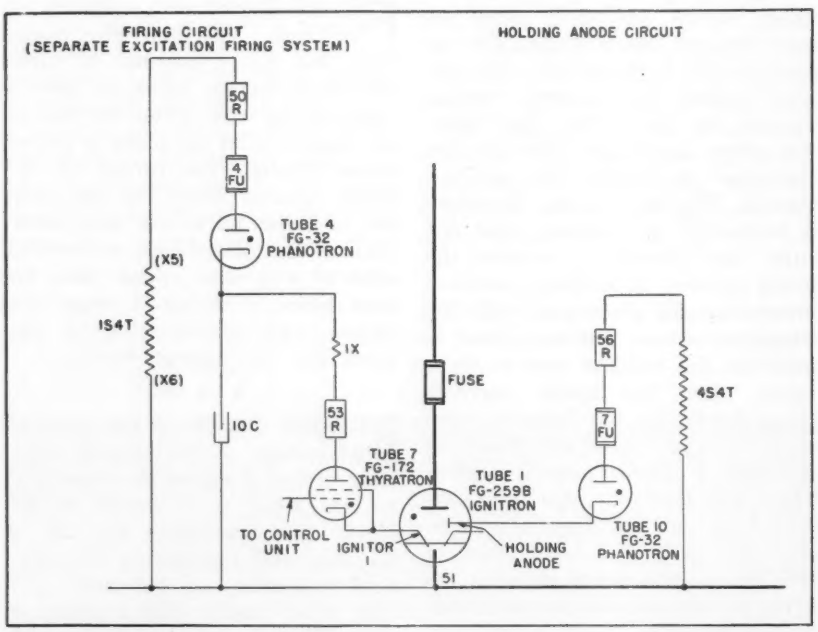

Fig. 10 — Excitation circuits of Thy-mo-trol used on wire darwing machine. * * * * *

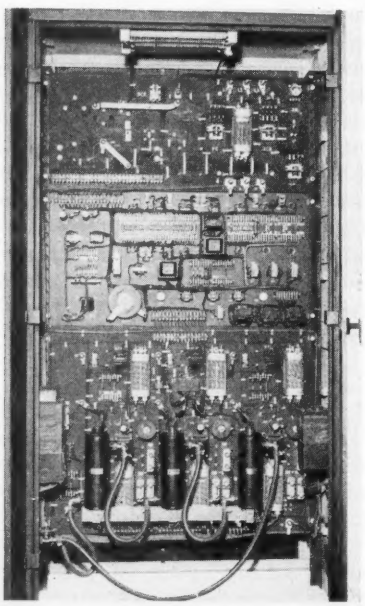

Fig. 12 — Rear view of Thy-mo-trol panel. * * * * *

slowly accumulates the excess wire. The blocks are arranged so that they can be declutched from the drive shaft in order to run off the reservoir of wire.

THE operating requirements for a machine of this type are much the same as for the other machines of the multiple block, single motor type, and therefore has the advantage that it can be driven by a constant speed a-c motor. To obtain the slow start and smooth acceleration the wound rotor induction motor is used. Where a range of

speeds is required for flexibility in drawing different sizes and grades of products, an adjustable speed d-c motor is used. Magnetic control is used in all cases to obtain the proper operating characteristics. Quick stopping is obtained by dynamic braking. The machine is operated by control bars which run the length of the machine.

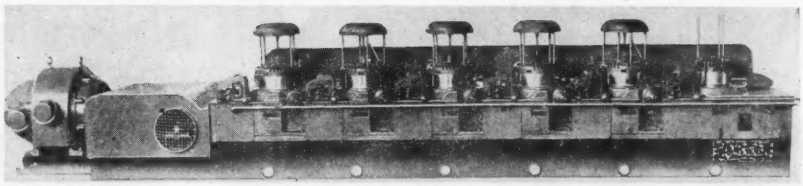

Fig. 13 — Multiple block wire drawing machine with single motor drive storage type for steel wire. (Courtesy Morgan Construction Co.) * * * * * *

* * *

Multiple Block With Each Block Motorized Storage Type

THE fourth and last type of wire drawing machine is the multi-block machine which has each block motorized. This type of machine is used almost entirely for steel wire drawing since its basic design is to eliminate slippage on the capstans and to coordinate the speeds of the capstans as the wire elongates. Since there is a speed coordination problem, adjustable speed d-c motors are used in every case, with the motor fields controlled to provide the speed coordination. Ordinarily the power supply is constant potential d-c but for those cases where a wide range of drawing speeds are required Ward-Leonard control is possible.

* * *

ONE machine design of this type is shown in Fig. #14. After the wire passes through the die, several turns are taken around the block, then around a pulley on a floating geared ring, around two more pulleys to the next die and so forth. The geared ring which operates independently of the block operates the field rheostat of the motor driving the block in such a manner as to keep the storage on the reel constant at all times. The advantage of this type of machine over the non-slip storage type just discussed is that the storage on the blocks is maintained constant, eliminating any tendency for excessive storage on the blocks.

* * *

ANOTHER machine of this general design has the motor speeds set manually rather than automatically. Hand wheels for each field rheostat are provided so that the operator can adjust the amount of storage on the blocks while the machine is operating.

* * *

Continuous Type

FIG. # 15 shows a machine of a different design and operating principle. This machine provides for no storage between capstans, except for a small loop around a dancer roll, and, therefore, is a continuous, fully automatic machine.

* * *

THE gearing for each capstan is laid out so that for full motor speeds the capstan speeds are such as to approximately take care of the elongation of the wire between dies. However, due to die sizes being off from the theoretical, it is necessary to provide a dancer roll which operates a rheostat in the field of the preceding capstan motor to adjust the speeds of the motors driving the capstans in such a way that the relative capstan speeds will be maintained to eliminate any slippage of the wire. Fig. #16 is a top view showing the way in which the machine is strung up. The wire passes from capstan to dancer roll to capstan until the final storage block is reached. If the capstan speed is low, the size of the loop will decrease and as the dancer arm is moved forward it operates a field rheostat to weaken the field of the preceding capstan motor and increase its speed. If the speed is too high, the reverse will take place. Fig. #17 is a back view of this machine and shows the manner in which the motors are mounted, as well as the field rheostats and the manner in which they are operated from the dancer roll.

* * *

MACHINES of this type are operated both on adjustable

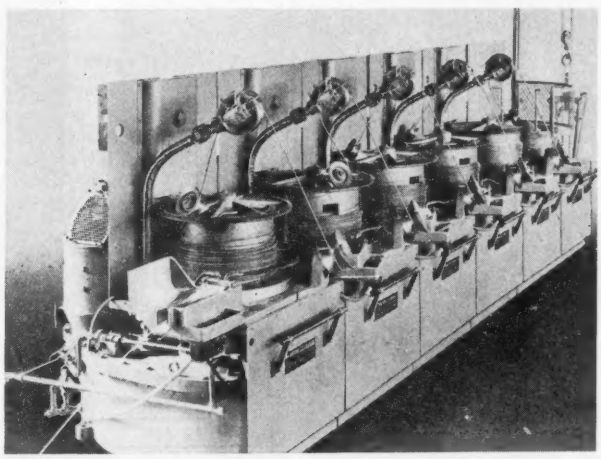

Fig. 14 — Multiple block wire drawing machine with each block motorized. Storage type. (Courtesy Aetna Standard Engineering Co.) * * *

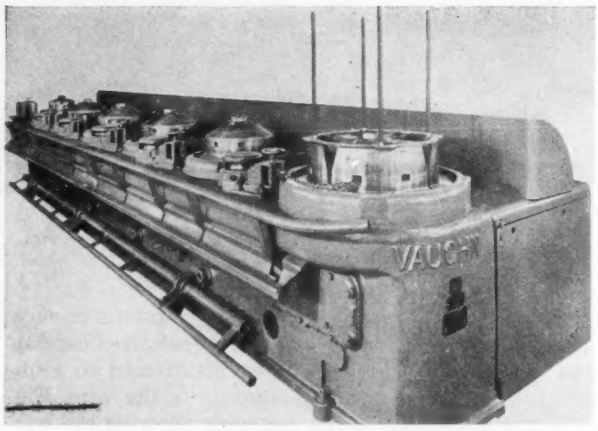

Fig. 15 — Multiple block wire drawing machine with each block motorized. Continuous type. (Courtesy Vaughn Mach. Co.) * * *

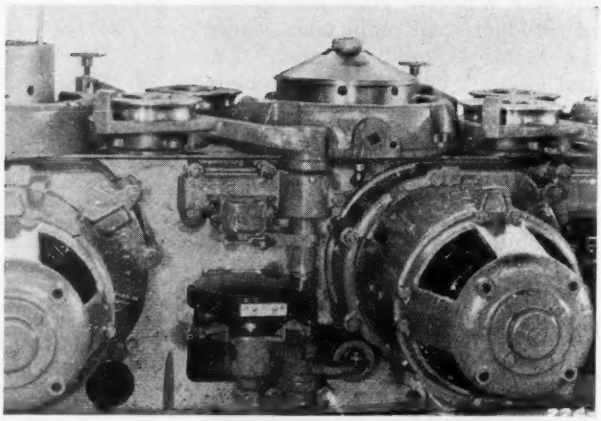

Fig. 17 — Rear view of continuous wire drawing machine showing the motors and the manner in which the field rheostats are operated by the dancer rolls. (Courtesy Vaughn Mach. Co.) * * * *

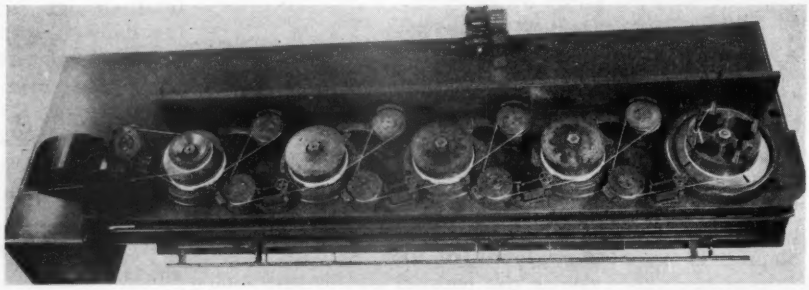

Fig. 16 — Top view of continuous wire drawing machine, showing manner in which the wire operates the dancer roll. (Courtesy Vaughn Mach. Co.) * * * *

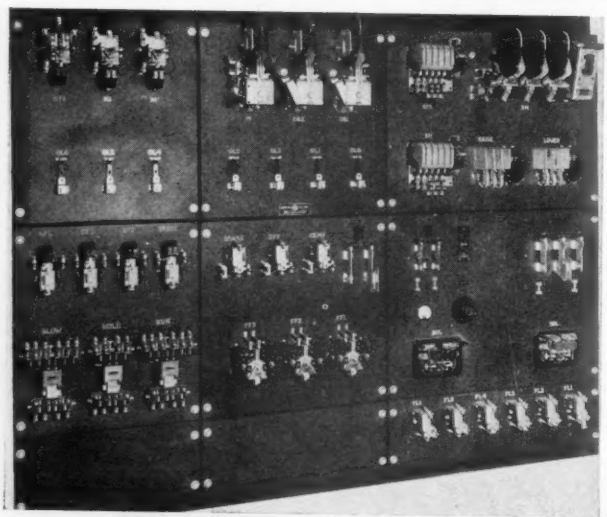

Fig. 18 — Front view of control panel for 6-motor continuous wire drawing machine with adjustable voltage drive. * * * *

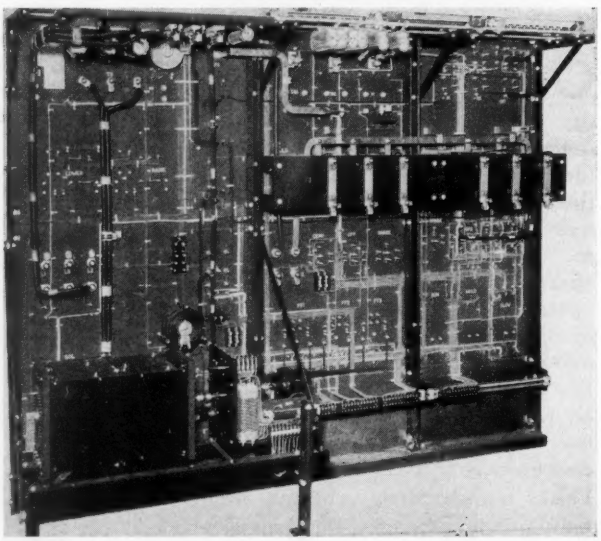

Fig. 19 — Rear view of control panel for 6-motor continuous wire drawing machine with adjustable voltage drive. * * * *

voltage and constant potential d-c, in which latter case all of the motor armatures are considered as a single armature and are started on the same starting resistor.

WITH a machine of this type part of the field range of the individual motors is used to synchronize the motors and the re-

(*Please turn to page* 265)

Corrosion Inhibitors in Theory and Practice

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Introduction

INHIBITORS have been appearing regularly since the early days when almost any organic addition was found to improve the acid cleaning process. Since then, inhibitor materials have been used in many other applications. Some of these inhibitors are good, others are only fair. The only valid criterion of effectiveness has been experimental testing, with the purpose of duplicating service conditions. Weight loss tests are the usual method of determining inhibitor effectiveness. It is unfortunate that a theoretical basis for predicting inhibitor performance is not available. Science here, as in other fields, has been outstripped by practical developments and applications. The purpose of this article is to discuss the mechanism of inhibitor action on the basis of present knowledge. Some of the many and varied applications of inhibitors will also be discussed.

* * *

THE use of inhibitor materials is important in many of the metal finishing and protection fields. On first glance this may not seem to be the case. However, the basic problem which underlies most of the work in these fields is the adsorption of organic molecules on a metallic surface. Pickling inhibitors, slushing compounds and paints are all dependent on adsorption to some extent for their effectiveness. The various applications where organic inhibitor materials are important have been summarized in Table I.

* * *

IT is evident that the term inhibitor cannot be used in a restricted sense. It may be defined here as any substance which when added to the environment of a metal will retard or prevent the corrosion of that metal. If corrosion were not a problem, there would be no need for inhibitors. Accordingly, a brief consideration of corrosion is necessary before discussing inhbitors.

* * *

Corrosion

CORROSION may be defined as the uncontrolled deterioration of any metal. Almost all metals corrode in aqueous solutions in the presence of oxygen. The spontaneous nature of such reactions has been determined thermodynamically.[1, 2, 2a] Accordingly, the real problem in considering corrosion is not whether a reaction is possible but whether its rate can be controlled. The important factors in corrosion are those that control the rate of discharge of the galvanic corrosion couples. When these factors are known, steps can be taken to reduce

Conclusions

THE large-scale use of inhibitors and inhibitor-type materials warrants a thorough study of their action and characteristics. The most desirable result to be achieved from a study of inhibitors would be a correlation of inhibitor structure and effectiveness. In this way the usefulness of such materials under various conditions could be predicted. The authors believe that the most fundamental property associated with organic inhibitors is the energy of adsorption of these materials. It is pointed out that present theories of inhibitor action are unsatisfactory in this respect, providing only a general picture of inhibitor behavior. Further work in this direction is needed, and a program along these lines is being carried out at the *Corrosion Research Laboratory*.

IT is shown that adsorption considerations will apply to most of the important inhibitors but not to all. To clarify the distinction the authors propose the following classification which includes all materials commonly known as inhibitors:

1) **Surface Conversion.**
2) **Adsorption.**
3) **Diffusion.**

ILLUSTRATIONS of each of these are given. It is pointed out that monomolecular adsorption, obtained with "adsorption" compounds, will account for the pitting sometimes obtained with such materials. A "critical concentration" corresponding to complete monolayer formation will also be characteristic of materials in this class. An economical inhibitor concentration will just exceed the critical amount.

CURRENT inhibitor applications are discussed in the second half of the paper. Inorganic materials, most of which can be classified as surface conversion inhibitors, are presented first. Applications of organic materials, which fall into the adsorption and diffusion class, are presented last.

TABLE I

METAL CLEANING
Pickling inhibitors.
Inhibitors for the removal of hard water scale and deposits.
METAL FINISHING
Compounds added to electroplating, electropolishing, and electrocleaning baths.
Oils used after bluing and other surface treatments.
Drying oils (materials which displace water).
Drawing compounds.
METAL PROTECTION
Paint primers and compounds added to increase binding.
Protective oils and slushing compounds.
Inhibitors for solutions which contact metal surfaces.
Packaging inhibitors (compounds which volatilize and protect against condensed moisture).

* **Contribution from the Corrosion Research Laboratory, Illinois Institute of Technology, Chicago, Illinois.**

the corrosion rate. The use of inhibitors is one such step. Inhibitors act to change the nature of an electrode surface by adsorption. The presence of such adsorbed films will interfere with the oxidation and reduction processes on the metal surface. A direct reduction in the corrosion rate will be the result.

* * *

Desirable Inhibitor Properties

INHIBITOR efficiency is usually judged on the basis of corrosion or weight loss reduction in tests close to service conditions. There are other factors, however, which must be considered before a material is used industrially. The following points are given to sum up all the desirable attributes of an industrial inhibitor.

* * *

1. High efficiency relative to cost. A costly material will pay its way only if it is highly effective. However, only very small amounts of a highly effective material would be required, representing savings in handling and storage costs.

2. Stability under a wide range of conditions. This includes stability in storage and in solutions of varying acid strengths and temperatures.

3. High solubility in all types of aqueous solutions with no special procedures required for dissolving.

4. Convenient form for handling. A solid material, non-caking and non-toxic, is probably the best.

5. Readily removable. This is particularly important in pickling baths where retention of inhibitor material on the metal might interfere with subsequent surface treatments. This property seems to be at odds with adsorption effectiveness. However, if a material is readily soluble as required by point 3, it should also be readily rinsed.

* * *

A difficulty found in some commercial inhibitors is their low solubility in water. In comparing inhibitors on the basis of equimolar amounts, it is often found that the most insoluble compounds are the best inhibitors. It may be possible to remedy this by introducing solubilizing groups such as the sulfonic acid radical. Quaternary ammonium compounds could also be used.

Current Inhibitor Theories

THE current ideas on inhibitor action will now be given. Most of the work on inhibitor action has been done with **organic compounds.** As a result the discussion of inhibitor theory applies to these materials unless otherwise stated: Following this, a survey of some important inhibitor applications is presented.

* * *

THE subject of inhibitors has been treated by many investigators and numerous theories have been proposed to account for the experimental observations. None of these, however, has provided a general basis for predicting inhibitor effectiveness.

* * *

RECENT work by **Mann**[3] shows that a single layer of adsorbed inhibitor molecules is chiefly responsible for reducing corrosion. In other words, the most significant reduction in corrosion is due to a monomolecular layer. This means that the most signficant factors governing inhibitor performance are the forces determining the nature of the monomolecular inhibitor layer. The problem of inhibitor effectiveness is thus seen to be a problem of determining the strength of the adsorptive forces bonding the inhibitor molecules and the metallic surface. This seems to be the key problem in the field of inhibitor action. The question is not confined to inhibitors, however, since adsorption is common to other fields also. A good statement of the problem is to be found in a book on catalysis from which the following quotation is taken[4]:

"These phenomena of chemical combination form the uncertain note in the explanation of certain adsorption phenomena, such as the adsorption of some of the so-called permanent gases by solids, while at the same time many other cases of adsorption were found to be due to "primary" or ordinary valence forces. It must be emphasized, however, that such surface phenomena, whether explained as due to secondary valence forces, or to the actions of electromagnetic fields, or to any other cause, are also well known among chemical compounds and reactions aside from those classed as adsorption and have been explained by the terms secondary valence, auxiliary valence, electrical attractions of various kinds, force fields, etc. Without attempting to account for the actions of these chemical forces in any final and definite manner, it may be said that the forces acting to form these adsorption compounds differ in no way from the forces which have been observed in other reactions. Their interpretation is not as direct at the present time as the interpretation of the chemical unions which involve definite changes in the positions of electrons, but it appears probable that an explanation for the former will be found in the configurations or in changes in the configurations of the electrons in the adsorbed molecules or atoms and the adsorbing surface. An explanation involving such views was suggested by Harkins and King. At any rate, the statement which has been made repeatedly is not modified by these considerations, that the forces acting in adsorption phenomena are identical with those acting in the formation and reactions of chemical compounds in general."

* * *

ALTHOUGH the above quotation is not recent, it still applies to present-day considerations. All investigators agree that the primary action of organic inhibitors is to form some type of surface layer or film on the corroding metal. There is some difference of opinion, however, on just how this adsorption takes place.

* * *

THERE are several factors which have been considered in studying the adsorption process. These are:

1) the anodic and cathodic nature of different parts of the metal surface,
2) the existence of "active centers" on the metal surface with differences in adsorptive capacity,
3) physical or chemical nature of the adsorption as determined experimentally.

* * *

THE non-homogeneous character of the metal surface is responsible for the first two factors. In regard to anodic and cathodic areas it is widely believed that cathodic adsorption is chiefly responsible for inhibitor effectiveness. **Mann**[5] regards the adsorbed inhibitor material as simply preventing contact between the metal and the corrodant, and proposed a mechanism of inhibition based on the formation of **"onium"** compounds. **"Onium"** compounds are organic cations formed by the combination of an organic molecule and a hydrogen ion or proton from solution. Since this is the case, **Mann's** theory is limited to organic inhibitors and to acidic solutions. The theory proposes that in such solutions a small amount of onium compound exists in equilibrium with the dissolved inhibitor. The positively charged inhibitor radicals drift to the cathodic areas of the metal surface along with hydrogen ion which is being

discharged there. Hydrogen gas is evolved, but the organic cations accumulate at the cathodic areas and prevent the further discharge of hydrogen ion. The proton of the onium compound may be discharged also, in which case inhibitor molecules accumulate at the cathodic regions. It is presumed that in the pickling process appreciable adsorption does not take place on iron scale so that attack on the scale is not interfered with. Other investigators have shown that the attack on the scale is chiefly confined to the metal-scale interface[6]. It follows that inhibitors have little effect on the action of the galvanic cell between iron and its oxides.

* * *

THE idea of cathodic adsorption is also favored by **Lawrence and Walton**[7] and by **Warner**[8] and **Jimeno et al**[9]. **Lawrence and Walton** believe that the inhibitor acts to blanket the surface and shield the metal from the corrodant. The others propose that the chief effect is to increase the hydrogen overvoltage and thus reduce the potential difference between the anodic and cathodic areas.

* * *

MACHU[10] and **Rhodes and Kuhn**[11] believe that the inhibitor layer acts to increase the interfacial resistance of the metal and its environment. As a result the discharge of hydrogen ions which involves electron transfer from the metal to the solution is reduced. **Machu** believed that adsorption was strongest on the anodic areas.

* * *

MOST later work tends to the view that adsorption is general[12],[13]. It seems likely that this is the case with uncharged molecules, although positively charged ions probably accumulate in the vicinity of the cathodic or negatively charged areas of the surface. The rest of the surface is also presumed to be covered.

* * *

IF general adsorption is the rule then the nature of the surface will play a different role in determining the extent of adsorption. Some investigators who have proposed general adsorption have introduced the idea of active centers, originally developed in the field of catalysis. The presence of such centers was introduced to explain the "poisoning" of certain catalysts. The idea contributes little, however, to the understanding of inhibitors. One may say qualitatively that when an inhibitor is added to a system, the more active portions of the surface are covered rapidly and that adsorption then takes place more slowly on the less active areas. The difficulty with this idea is that it is hard to distinguish it from the idea of separate anodic and cathodic areas. Anodic areas are more active chemically than cathodic areas and can be called the active centers on a corroding metal surface. If one then says that adsorption takes place initially on the active centers, it is equivalent to saying that inhibitors act to inhibit the anodic reaction. It is generally believed that this is not usually the case. Either cathodic or general adsorption seem to be most important. Accordingly, this idea does not seem to be of much value in a discussion of inhibitors.

* * *

WITH reference to the third point mentioned above, it has been found experimentally that adsorption on solids can often be classified in one of two ways, either as physical or chemical adsorption. The differences between these two classes are marked and are due to the type of force involved in binding the adsorbed atoms or molecules to the surface atoms of the solid. Physical or **"van der Waal's"** adsorption includes those cases where the adsorption forces are of the **van der Waal's** type, such as the forces responsible for the condensation of vapors. Chemical adsorption occurs when the adsorbed atoms are held by covalent or by strong electrostatic forces to the underlying solid. These types are generally distinguished by the heats of adsorption, which are usually less than 4,000 calories per mol for physical adsorption, but at least 10,000 and even up to 200,000 calories per mol for chemical adsorption.

* * *

SUCH a distinction as the above is an important basis for the study of inhibitors, but unfortunately, sufficent data are not available on the adsorption of inhibitor molecules to permit quantitative comparison of heats of adsorption and inhibitor structures. All of the work which showed the necessity for recognizing two types of adsorption was done with gases, such as oxygen, ammonia, and sulfur dioxide. It is possible that two types of adsorption behavior will not be found for organic materials. In any case more work on the adsorption of organic substances is necessary before a theoretical basis for predicting inhibitor effectiveness can be developed.

* * *

ONE may say qualitatively that molecules are adsorbed on solids by interaction of the unsatisfied fields of force of the surface atoms with the fields of force of the molecules striking the solid surface. This is the point of view used by advocates of the adsorbed film theory of passivity. **Uhlig**[14], for example, attributes the passivity of stainless alloys in some cases to the fact that a strongly adsorbed layer of gas satisfies all the valence forces of the surface atoms. In considering inhibitors however, he makes a distinction between certain inhibitors which he calls "passivators" and all others. He believes that passivators are strongly adsorbed on the metal surface and diminish the chemical reactivity of the metal while inhibitors (exclusive of passivators) act to reduce the rate of penetration of corrosive elements to the metal surface. Some examples of passivators according to **Uhlig** are chromates, phosphates and sodium nitrite. Organic inhibitors fall in the other class. In this way the idea of physical and chemical adsorption differences is extended to inhibitors. Passivators are presumably chemisorbed while other inhibitors are physically adsorbed. Uhlig can base his distinction on the fact that passivators can react chemically to form oxide layers while organic materials do not do so. There is a serious objection to this distinction. One would expect to find a marked difference in

effectiveness between these classes under most conditions. This is not the case, however, since organic materials are often the more effective. In small concentrations "passivators" sometimes increase corrosion while organic materials rarely do so. The authors believe that there are no sharp differences in the adsorption of these types of materials and that the same valence forces are responsible for inhibition in each case.

* * *

PASSIVATORS may subsequently react to form a surface film, which may or may not be protective. If the film is the important factor in protection, then the "passivator" should not be called an inhibitor but a surface conversion agent. If the film is secondary to protection then the material presumably protects by adsorption and may be called a true inhibitor. It seems to the authors that there is no reason to distinguish certain materials as "passivators" when the classification of surface conversion agents serves just as well. All inhibitors serve to passivate a metal surface by making it less reactive. It has been shown several times that organic inhibitors change the potential of a corroding metal to a more noble value.[3]

* * *

Classification of Inhibitors

THE above considerations have led the authors to a new classification of inhibitor types. The discussion of adsorption was concerned primarily with organic inhibitors as most of the experimental work has been done with these materials. The following classification is presented to show exactly where adsorption is important in the entire field of industrial inhibitors which includes inorganic salts as well.

* * *

THE authors believe that all inhibitors can be placed in one of three classes:

1) **Surface conversion inhibitors.**
2) **Adsorption inhibitors.**
3) **Diffusion inhibitors.**

* * *

THESE three classes are illustrated in figure 1 and examples of each type are given. The first class in-

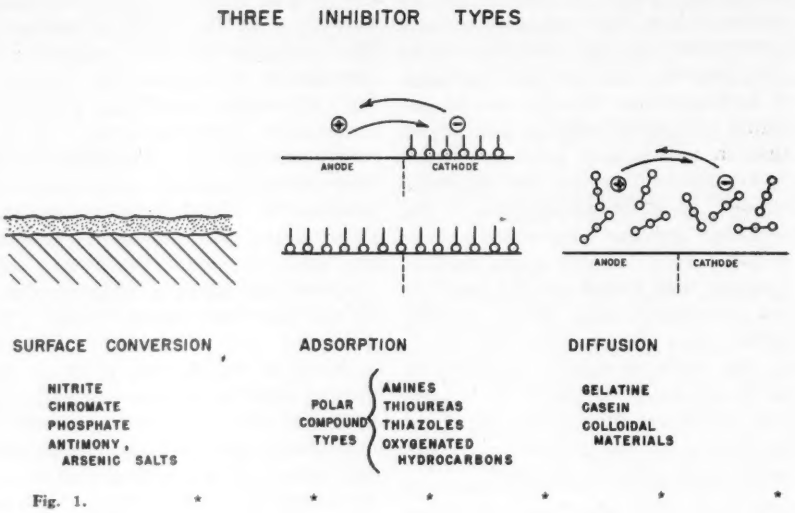


Fig. 1.

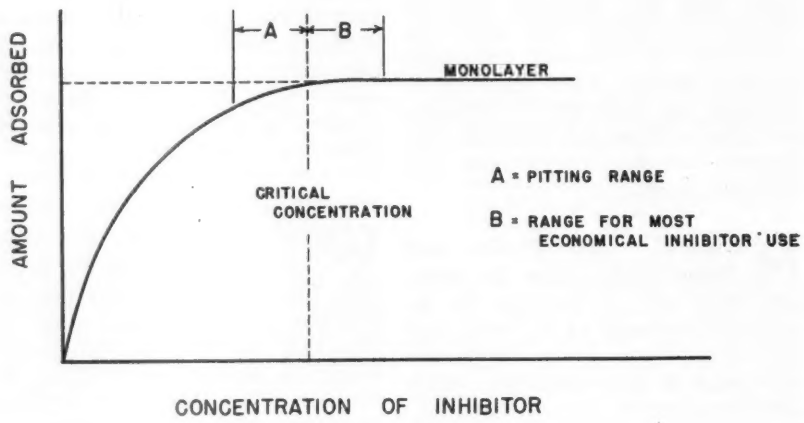


Fig. 2.

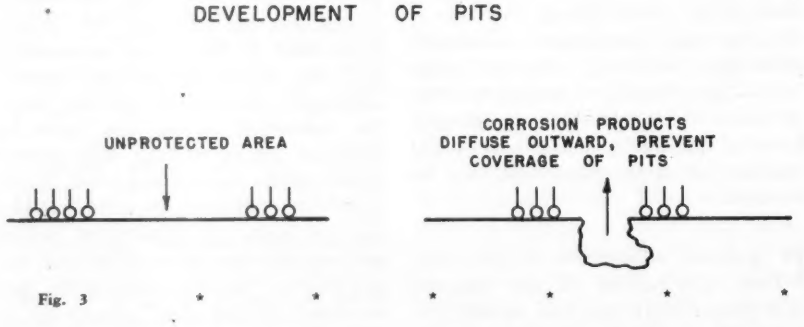


Fig. 3

STEP 1: The inhibitor concentration is insufficient to maintain complete surface coverage.

STEP 2: Once a pit develops the inhibitor cannot seal the point of attack by normal diffusion and adsorption.

cludes those materials which can react chemically with the metal and whose reaction product is relatively impermeable to the corrosive medium. Heavy metal salts such as those of antimony and arsenic are included since they also change the nature of the metal surface by chemical reaction. It is evident that the protection afforded by surface conversion agents will increase with time as the protective layer is built up. It is likely that adsorption is the first step in protection with sodium chromate. The protection does not stop here, however, as in the case of the next class but continues with the formation of a protective layer by chemical reaction. This fact serves to distinguish this type of inhibitor from the remaining two.

* * *

THE next type are the adsorption inhibitors which include all the important organic materials. These materials will not react chemically with the metal surface but from an adsorbed layer which prevents electrochemical action. This adsorption may be specific, beginning initially at the anodic or cathodic areas. The end result, however, will probably be complete surface coverage. In the illustration the adsorption is initially cathodic and then general. The arrows indicate the direction of ion movement in the solution as galvanic action takes place on the metal surface. Ionic conductance, of itself, is not affected by adsorption inhibitors but is affected by the materials of type 3 which are called diffusion inhibitors. These materials are not distinguished for their adsorption but serve to increase the viscosity of the medium and lower the ionic conductance. In this way the internal resistance of a galvanic cell is increased and corrosion is reduced. In general, this class is less effective and less important than classes 1 and 2.

* * *

THE diffusion inhibitors are readily distinguished by means of the **Pulse Polarizer**, an instrument in use at the **Corrosion Research Laboratory** to evaluate inhibitors. The Pulse Polarizer and its applications are discussed in a recent paper[15]. The instrument is used to determine the rapid potential changes taking place in a pair of electrodes when a large pulse of current is suddenly passed through the system. The rapid electrochemical action which takes place produces very distinctive potential variations which depend on the polarization characteristics of the cell. It was found experimentally that the potential of an electrode after the pulse of current has passed does not return completely to its original value in the case of adsorption inhibitors. However, in the case of gelatin, classified by the authors as a diffusion inhibitor, the final potential value is always equal to the initial. As might be expected, the time to return to the original value increases with increasing concentration of gelatin. In other words, an electrode is permanently polarized to some extent when an adsorption inhibitor is used. There is no residual polarization, however, when diffusion inhibitors are used.

* * *

Langmuir Adsorption and Pitting

IT may be assumed that adsorption of inhibitors takes place through the polar group and the amount of adsorption depends on the concentration in solution. If the concentration is below that necessary to maintain a monolayer, then the amount of adsorbed material is probably determined by the Langmuir relation

$$X = \frac{a\,c}{1 + bc}$$

where X is the amount adsorbed,
c is the concentration,
a and b are constants.

The applicability of this relation has been verified by **Mann.**[3]

* * *

IT may well be asked what applicaton can be made of the fact that monomolecular adsorption is chiefly responsible for inhibitor effectiveness. The answer to this can best be made by reference to figure 2. Here a typical adsorption curve which follows the **Langmuir** equation is shown. Amount of inhibitor adsorbed (grams per cm.^{2}) is plotted vs. concentration of inhibitor in solution. It is seen that at low inhibitor concentrations the amount of adsorption goes up linearly with concentration. At high inhibitor concentrations a constant amount (enough for a monolayer) is adsorbed. There is a certain concentration which will just maintain a monolayer. This is denoted by the dotted line and is called the "critical" concentration. Just below this value a complete surface layer will not be maintained and corrosion attack will center on the unprotected areas. Such a condition will result in pitting. At lower concentrations most of the surface is unprotected and general attack takes place. As a result pitting only occurs in a certain range of inhibitor concentration and changes to general attack at lower concentrations. The factors responsible for pit formation are illustrated in figure 3. It is seen that the inhibitor is ineffectual against such attack and is actually defeating its purpose. Pits will continue to develop until stifled by their own corrosion products. In agitated or circulating solutions this will not happen readily and deep pits are more likely to form than under stagnant conditions.

* * *

IT is evident that the critical concentration must be maintained if an inhibitor is to be of value. To be entirely certain of protection a safety margin should be maintained to keep out of the pitting range. There is no point, however, to adding a large excess of inhibitors, since no additional protection can be obtained once the critical concentration is exceeded. It is assumed in making this statement that we are dealing with adsorption inhibitors which are only effective on the surface of the metal and whose effects on corrosion when remaining in solution are negligible. In other words the above discussion applies only to adsorption inhibitors and not to diffusion inhibitors. Even as such it includes all the important organic materials used commercially. It is also obvious that the idea of a monolayer cannot be applied to surface conversion inhibitors where the thickness of the coating

will depend on the time of contact of the metal with the inhibited solution.

* * *

Commercial Inhibitor Applications

ATTENTION will now be turned to industrial inhibitor applications. All commercial inhibitors may be placed in one of three classes according to their structure. This has been done for convenience in discussion and is not to be confused with the classification based on type of inhibition.

1) Inorganic salts whose anions are polyatomic and contain oxygen in addition to the nucleus element; examples are $NaNO_2$, Na_2SiO_3, Na_3PO_4. These are surface conversion type inhibitors.

2) Inorganic salts whose cations or anions contain heavy metal salts which possess high hydrogen overvoltages in the massive state; examples are Na_3AsO_3, $SbCl_3$, $HgCl_2$. These have also been classed as surface conversion inhibitors.

3) Organic compounds, or salts containing an organic cation or anion; examples are amines, substituted thioureas and organic acids. This class includes adsorption and diffusion inhibitors.

* * *

Inorganic Materials

ALL of the substances of the first class apparently act by a precipitation mechanism to form surface layers or films which reduce the rate of diffusion of solvent to the metal. Adsorption is probably the first step in the formation of this film. The oxygen-containing anions can form insoluble compounds with the heavier metals such as iron, and the presence of such solids has been shown.

* * *

THE most well known of these substances is probably sodium chromate (or dichromate), which has been used for steel material in water or salt solutions, such as brine in refrigerating units. The relative advantages and disadvantages of this inhibitor are thoroughly discussed in an early paper.[16] It is generally believed that chromate ion acts by reacting with the ferrous ion produced by dissolution to form a solid mixture of oxides which adhere to the surface and shield the metal surface. On an iron surface the mixture contains Cr_2O_3, Fe_2O_3 and possibly Fe_3O_4, all of which are probably hydrated.

* * *

ANOTHER mechanism for the action of chromate ion has been advocated by **Uhlig**.[14] He believes that the anion is chemically adsorbed at the metal surface without undergoing significant change in its structure. It seems likely that adsorption is the first step in protection and that reaction to form a film is the second.

* * *

CHROMATES are less effective at higher temperatures and in the presence of chloride ion. Chloride salts are generally deleterious to all types of oxide films.

* * *

IN spite of these limitations chromates are widely used. They are readily soluble and cheap and salt solutions used in refrigerating and air conditioning equipment are usually treated with chromates. Chromate inhibition of aluminum in phosphoric acid, well water and other solutions has been shown to be effective.[17] About 0.5 per cent by weight of sodium chromate in addition to some sodium hexametaphosphate is added to acid dye solutions to prevent attack on stainless steel equipment.[18]

* * *

AIR is present in all the above cases, and one might consider that part of the protection is due to the passivating effect of oxygen. However, chromates have also been successful under anaerobic conditions, and protection has been obtained in condensate gas wells, an acid system with no air present.[19]

* * *

IN addition to these uses, chromate solutions have been used to produce protective coatings on sheet metal. These are the familiar surface conversion coatings. Other uses are in primer paint pigments, and zinc chromate is widely used in this regard.

* * *

PHOSPHATES are widely used both as inhibitors and as surface conversion agents and have been used in many water systems, especially sodium hexametaphosphate. These compounds have been found to inhibit corrosive attack on many different metals and are useful in scale removal.

* * *

SODIUM silicate is used in a variety of applications. It has been recommended as an efficient inhibiting agent for small water systems.[20] It has also been used effectively in various phases of the petroleum industry, and di-silicate has been found to prevent the action of basic media on aluminum, specifically in hot sodium carbonate solutions. High concentrations of di-silicate are needed in this application.

* * *

A surprisingly effective inhibitor in certain applications is sodium nitrite. One would not predict such effectiveness from the close structural relationship of nitrite and nitrate ions. Sodium nitrite has been used to prevent corrosion of steel exposed to gasoline, alcohols and various other organic compounds. A small amount of water with dissolved sodium nitrite is added to these materials. In aqueous media the inhibitor is said to be effective for steel when the pH is 6 or greater.[21] More inhibitor is required when chlorides are present since chlorides reduce the efficiency of all inorganic inhibitors belonging to this first class.

* * *

VARIOUS cations have been investigated as possible corrosion inhibitors. Among these are zinc, manganous, and chromic ions.[22]

* * *

THE second class of inorganic inhibitors includes those metal salts which can be used where the hydrogen evolution type of attack predominates. Such substances are arsenious[23] and antimonous salts.[24] which have proved useful for steel exposed to sulfuric and hydrochloric acids. These metal ions plate out on the cathodic areas of the metal being attacked where they serve to prevent further hydrogen evolution by reason of their high overvoltages. A recent report[25] stated that arsenic in the form of arsenious oxide could be used to protect steel in 65-70 per cent sul-

(*Please turn to page* 260)

Portsmouth Steel Corporation

THE EARLIEST OF THE MODERN WIRE MILLS

By Kenneth B. Lewis

Consulting Wire Mill Engineer
Worcester, Mass.

An outline and history of the development of the Portsmouth Steel Corp. at Portsmouth, Ohio. The eighth of a series of articles on the history of American Wire Mills.

EVERY man has had two parents, four grandparents, eight great grandparents, sixteen great great, and so forth as far as you care to keep doubling. After fifteen or twenty generations you are really appalled at the number of ancestors you appear to have had, and if you keep it up for a hundred generations, say back to about the time of the siege of Troy, and pursue sound actuarial methods of calculation, you will find yourself linked by ties of blood to practically every inhabitant of the civilized world. The curious fact forced itself upon me as I looked back over the origins of the **Porthsmouth Steel Corporation** and tried to sketch for her a neat and plausible family tree. It can't be done; she had too damned many ancestors.

* * *

IN about the year 1796, when George Washington was setting forth his sound belief that two terms in the presidency were all that any man could safely accept, and men of good sense were seriously discussing the qualifications of John Adams, a trickle of Revolutionary veterans began to flow down the Ohio river past Pittsburgh and Wheeling, and on to Ashland, Ironton, Portsmouth, and Cincinnati. These towns were not merely unnamed, but unsettled at the time, and I consider it remarkable that the pioneers even found them. Small iron deposits were scattered all along the river, as well as inland; among the settlers were Pittsburghers and others familiar with iron manufacture, and it is not surprising that within sixty years Southern Ohio had no less than fifty-two blast furnaces. Even before the blast furnaces came crude Catalan type hearths, producing a dirty kind of wrought iron that was a little better than no iron at all. An iron industry developed there so quickly and was so enthusiastically supported by the population that what with the incorporations, failures, re-organizations, mergers, sales, holding companies, and the like, nearly every ferrous enterprise in the valley can be shown to be linked to any other you choose to mention.

* * *

BUT every unit deserves a pedigree of some sort. **Frank H. Rowe**, now supervisor of safety and personnel relations for the **Portsmouth Steel Corp.**, prepared a history of the ferrous industry in Scioto County, at the time of the recent sesqui-centennial celebration of the opening of the Northwest Territory. This material has been published by the Ohio State Archaeological and Historical Society, and Mr. Rowe was kind enough to lend me a copy when he learned of my interest. From this book I have sketched out a line of descent that seems to me the most direct and significant; here it is.

* * *

IN 1831 the firm of **Glover, Noel & Co.**, dealers in dry goods at the settlement of **Franklin Furnace**, decided that there was a future in the iron business, and commissioned the **Maddock Foundry & Machine Co.** to build them, at Portsmouth, a rolling and slitting mill, with the accompanying "nobbing" furnaces to produce wrought iron from the pig available in good quantities in the district, particularly from certain new furnaces just coming into production. The venture was capitalized at $100,000. The plans were threatened by a disastrous flood, later the fly-wheel, a huge structure of mixed wood and iron construction, burst, with no particular advantage to the plant, and in 1834 the new undertaking sank quietly to rest. Its name, **Portsmouth Iron Co.**, lapsed, but only temporarily.

* * *

IN the same year **Thomas G. Gaylord** came from Pittsburgh on a visit, liked the looks of the plant, bought it, and gave it his name. He gave in exchange his queensware business in Pittsburgh, and a good deal of rather rugged mountain land in the interior of Pennsylvania, which the recipients felt they were stuck with, and unloaded as best they could. Some years later, yes, you guessed it, oil was discovered on these useless acres. The plant of **Thomas G. Gaylord & Co.** was promptly improved by the replacement of the nobbing furnaces if you call that an improvement, and by the addition of hammers to compact the blooms before rolling. Thomas' cousin, **Benjamin B.**, came into the business, and eventually became the leading figure in the district. His interests reached out until there was scarcely a manufacturing venture in the valley with which he and his company were not linked.

* * *

THE **Portsmouth Iron Works**, officially **Thos. G. Gaylord & Co.**, prospered and grew. In 1861 it appears in the news as the source of iron plates for gun-boats operated by the Union armies on the Mississippi and Ohio rivers. In 1869 it distinguished itself as one of a group that failed to appreciate the

Kelley pig-boiling process for steel-making, forerunner of the Bessemer process. This process was demonstrated extensively in Lawrence County, but because of the opposition of the puddlers, who constituted a powerful labor faction at the time, it was turned down. It is probable that Mr. Gaylord was losing his grip; he was well along in years. In 1877 there was a disastrous strike and no profits, Mr. Gaylord was definitely losing his grip, he suffered a long spell of sickness, and died in 1880.

* * *

THE enterprise had been running as a stock company since 1872, under the name **Gaylord Rolling Mill Co.**, making boiler plate, sheets, bar iron, rivets, and cut nails. Upon the death of Mr. Gaylord it was reorganized as **Portsmouth Iron & Steel Co.** It ran until 1889; then after an extended period of idleness it was taken over by the Burgess Steel & Iron Works, whose leading spirits were **Levi York** and **George Davis.** This Burgess concern was right on the ball at that time, and I shall digress a little to cover it adequately.

* * *

THE gradual decline of the Gaylord enterprise appears now to have been due largely to its failure to get successfully into open-hearth steel, then a new and coming metal. Mr. Gaylord's pep was pretty well worn down, and his successors had not quite measured up. In the case of the Burgess concern, we find, on the other hand, a willingness and ability not merely to snatch what was already offered in the way of technological advance, but to push ahead into new territory. **Charles Burgess** came here from England in 1870, and was invited by **John R. Williams** of the Ironton Rolling Mill to demonstrate at that mill a process of converting iron to steel, which he had already developed and patented. I have read over his patents and in spite of my early days as puddler and as open-hearth melter, they don't mean much to me. The general feeling at the time was that the patent papers did not adequately describe the process, and that there was something secretly added to the bath in the puddling furnace just before the product was balled.

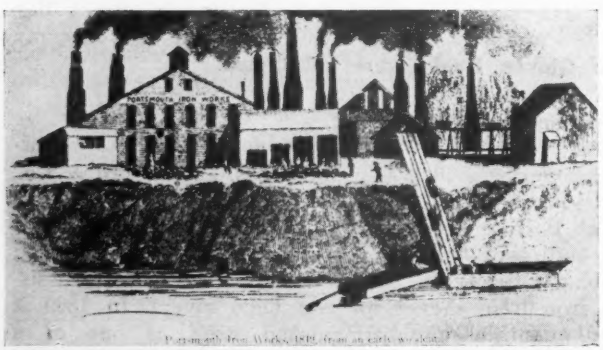
* * *

WHATEVER the process, there was general agreement that the product was truly remarkable. As a soft iron it was unrivalled for boiler plate, it made a hit for wagon tires and plows, and a bloom that was sent to Sheffield and worked into cutlery was pronounced equal to the best English steel. Implements that had long been made of iron faced with the more expensive steel, could now be of solid steel and still be cheaper than the composite metal. In 1871 **Burgess** found that a rolling mill in Portsmouth was idle and going cheap, and bought it, organizing the **Burgess Steel & Iron Co.** Burgess didn't stay long; he went back to England, but his banker associate, **George Davis,** carried on in his place. Davis had interests and connections all through the iron industry. He secured **James York** from Akron to head up the mill. In 1884 they turned out 7000 tons of steel. They had 400 men, eleven puddling furnaces, one 24-pot crucible furnace, and a nine-ton open-hearth.

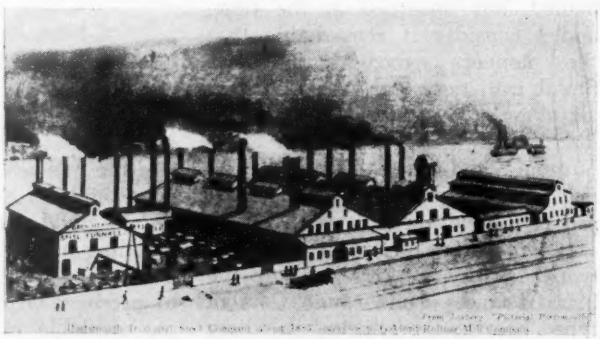
IN 1879 **Levi York** joined his brother as roll turner, and in less than a year climbed to the superintendency, displacing his brother James who went over to manage the fading Gaylord plant. Levi York was a human dynamo; I am not going to try to indicate the Portsmouth industries in which he played large roles, or I should never get around to the wire mill, but I will mention the "jail bars" that he invented. These involved a new type of steel, a composite bar which was partly soft iron and partly hard steel, and was said to rip the teeth out of a hack saw in jig time. Out of this invention grew a business of designing and building jails that is still flourishing in Covington, Ky., as **Fries & Son.** An offshoot of the jail bar was the safe plate, a composite plate that baffled the can-openers of that day. Levi York was forever patenting and exploiting new steels and the Burgess plant grew like a weed. In 1890 the Burgess Co. operated the old Gaylord mill which had recently folded up. This is another of the links in the chain that connects the various enterprises that have borne the Portsmouth name.

* * *

ONE night in June of 1898 the Burgess mills were destroyed by fire, and since it appeared that if they were rebuilt on the same spot there would not be room for the expansions Mr. York had in view, plans were made for a new mill far to the eastward, near the city line. Eventually a dispute about a right of way pushed the mill over the town line into New Boston, a name that will sound familiar to



Portsmouth Iron Works, 1849 * * * *



Portsmouth Iron and Steel Co., 1885 * * * * *

all who have visited the present plant.

* * *

THESE were the days of mergers, consolidations, "Trusts," and the like. Big money had just become aware of the steel industry, and steel processes were reaching a point where bigger money was needed than could as a rule be drummed up in one community. The **U. S. Steel Corporation** was in process of birth. Officials of the Corporation approached the owners of Burgess but were snubbed. But consolidation was in the air, and Mr. York was finally hooked by another octopus, the new **Crucible Steel Co. of America.** July 15th, 1900 saw the last of the names Burgess and Gaylord in Portsmouth. The officials of the new company visited the city, were wined and dined, and reassured the Board of Trade as to the permanence of the plant.

* * *

THE apprehensions of the Board were entirely justified. It was clear to the insiders that all the Crucible people wanted was to get the jail bar patents and then ditch a formidable competitor. The Burgess steel makers were putting out an open-hearth steel and selling it as crucible, and it was standing up at all the crucible tests, which was raising hell with the big corporation whose name was Crucible. Now we are getting into modern times. When I was studying metallurgy and starting in making steel, about the turn of the century, there was a lot of talk of the Burgess jail bars; we had them under the microscope. And there was a story going around about Crucible getting their ears pinned back by some open-hearth practice out in the sticks. The Burgess mill ran six months under the new ownership, then quietly locked the doors.

* * *

INTERESTED people in Portsmouth kept the world informed that they had a nice new steel mill crying for a tenant, and within a year they had a bite. Two mills in Wheeling, **Whitaker Iron Works** and **Laughlin Nail Works,** operated sheet mills, buying sheet bars in the vicinity, and began to doubt whether, in view of current consolidations, their steel supplies were secure. In 1902 they took it over as **Portsmouth Steel Co.** As a source of steel for the Wheeling plants it was a failure because of adverse freight charges, and it became plain that they would have to operate the plant independently on its own merits. They re-organized as **Whitaker-Glessner Company, N. E. Whitaker** as president and **W. L. Glessner** as vice-president, and added the **Wheeling Corrugating Co.** to their assets. Until 1915 the mills operated under the name Portsmouth Steel Co., the new title belonging to the holding company, but after 1915 the Whitaker-Glessner title became that of the entire undertaking.

* * *

RIGHT about here wire began to come into the picture; my readers doubtless think it is about time. Mr. Rowe's account says that the decision was made in 1920, but there must have been rumblings much earlier, for I called on the general superintendent at Portsmouth in 1917, and I never traveled for pleasure. It was that June day on which American youth responded to the summons to register for the draft for World War I, and I recall having to push my way through the crowds of boys to reach the New Boston bus. The man I talked with was **Frederick E. Fieger,** consultant in sheet mill practice, who was acting superintendent during the illness of **Andrew Glass.** Fred Fieger went to Aliquippa shortly after, and rose step by step behind **Tom Girdler,** to the vice presidency of **J.&L.** I never chanced to meet Andrew Glass, but I have often wondered if he was the Andrew Glass who, at the turn of the century, represented a certain institution of learning in New Haven and was accustomed to crawl the length of Soldiers' Field with the whole Harvard eleven on his back. How I hated that man, whoever he was!

* * *

THE first interview came to nothing, but the idea persisted. The constituent companies were makers of cut nails, and their product was taking a technological shellacking from old man Progress, so their natural instinct was to get into wire nails. The title of Whitaker-Glessner persisted long enough to get onto the Morgan Construction Co.'s order books for a rod mill and a mess of wire machines, and then gave way to another. The company merged with **LaBelle Iron Works and Wheeling Steel & Iron Co.** under the name **Wheeling Steel Corporation,** by which it is best known to our generation. Alexander and Andrew Glass and Isaac Scott, with W. H. Abbott and William Manning, were the officers. The change of name first affected the Portsmouth mill in 1923.

* * *

IT was our practice at **Morgans** in such cases to pick a good operating man and get him onto the job at the beginning, so that he would have a voice in all the planning. We secured **George A. Paff,** then with Page Steel & Wire Co., previously at Aliquippa, and with an earlier record at Sharon. George came into wire through the machine shop, originally, and was always better known as an executive and "good housekeeper" than as a technical man in the wire field. This was 1921; the Morgan-Connor wire machine was on the drawing board, in fact a demonstrator was in operation, and George looked it over wth great interest. It was then decided that I should take him to England where he could see Connor's mill in operation. We made the trip in October of 1921, and I wish now to remind any readers to whom George may have imparted highly spiced anecdotes of that trip, that George was a great kidder.

* * *

GEORGE recognized the value of the Morgan-Connor, but I kept wondering why his enthusiasm did not run a little higher until at last I found that he had been nursing the idea of bull blocks direct-connected to individual adjustable speed motors. He had a number of them built with various designs of transmission and control and ran competitive tests at Portsmouth, on the basis of which the new wire

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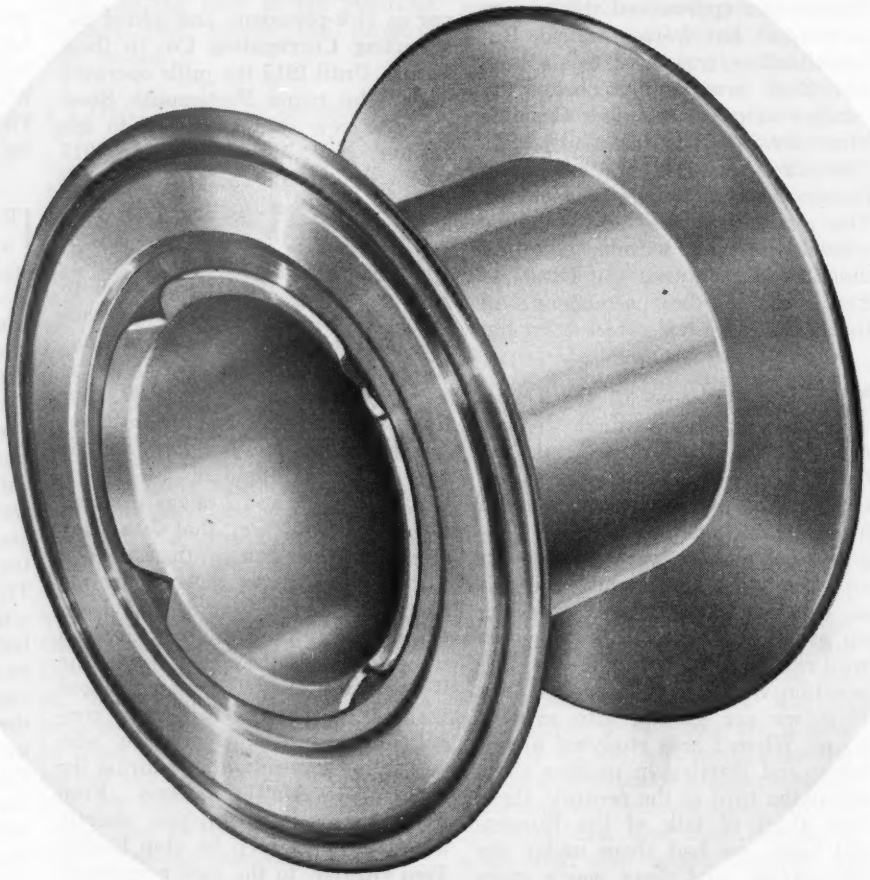

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ACROPAK means greater precision! Concentricity, true flanges, dynamic balance and closely toleranced traverse assure perfect packaging. ACROPAK provides even drawing tension and eliminates traverse adjustments which, in turn, cuts costs, and assures minimum wire breakage both in packaging and in take-off.

SIZES AVAILABLE FROM STOCK

Flange Diam.	6"	4½"
Barrel Diam.	3½"	2½"
Traverse	3 to 3½"	3 to 3½"
Arbor Size	⅜" to 3"	⅜"

DURABLE

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LONG LIFE

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mill was equipped with these units for all one and two hole work, and Morgan-Connors for three and four hole. The **Vaughn Motoblock** was a direct outgrowth of these trials.

* * *

THE initial equipment, other than the rod mill, which was the best of its time and whose product is even now very hard to beat, was about as follows:

For wire drawing, 108 Paff blocks and 12 four-block Morgan–Connors, to which was soon added a second-hand Vaughn bench and some 16″ Vaughn blocks for light gauges.

For field fence, eight machines bought from Keystone. Others have been added from time to time, the latest being nine originally from Peerless Fence Co. I should add that field fence was not made when the mill started up; it came in a bit later.

For bale ties there were added, beginning in 1928, Holmquist machines, single and five-wire, and later some Downeys...

Nail machines originally installed included six ten-penny from Wickwire Steel, and a number of Grayson–Gladers, from an unknown source. There were two staple machines, five double blow Bliss, and four rivet machines. For reasons unknown to me George was raking the mills for used nail machines. At one time he had 175 in operation; the number has been reduced to 91.

* * *

GALVANIZING was started on two 36 wire units of standard construction, with **Vaughn** take-ups. Pot annealers were designed on the spot and built locally. Twenty four used **Glader** barb wire machines and twelve new **Bates** machines made up the initial installation, which has now been reduced to a total of twenty five.

* * *

THE road mesh department started with the installation of a 102″ loom in 1927, to which have been added one of 122″, and two of 150″ width.

* * *

IN the matter of personnel George was fortunate in having worked as head of several wire mills and commanded quite a following. He drew on Page and J.&L., on the other Monessen mill, Pittsburgh Steel Co., and on the valley mills at Ashland and Ironton. **Ralph Hope** whom he broke in as assistant, was a local boy. **John Glenn** came from Monessen to head the nail mill, succeeding **William Smeltz** of A.S.&W. Co., who had served briefly at the start. Other early arrivals were **Wood Moyer, Gerald Crowe, Jack Seibert, John Arthurs, Harry Saunders, Ernest Milligan** (from Sydney N. S.), **Carl Horn, Ike Henthorn, W. B. Gardner,** and the **Cinereski boys, Joe, Mike,** and **Frank,** all from Pittsburgh Steel. For the most part the men stick to the job pretty well in Portsmouth. Most of those named above are either retired and living in town, or still on the job.

* * *

GEORGE **Kitchener** was a veteran on Morgan Rod Mills when Paff took him from Aliquippa in 1922. He died while this article was in Portsmouth for review. In the galvanizing shop **James Wilson** came with Paff from Page and died in harness. His successor **Lance Smith,** came with him, and is now

H. N. Snowden, Superintendent Rod & Wire Division Portsmouth Steel Corp., Portsmouth, Ohio. * * * * *

in charge of annealing. **John Olson** came from Monessen to start the barb fence machines and stayed with them till he retired.

* * *

FRANK **Morgan** came from Aliquippa to start the wire room, and stayed until his retirement. As I run through the list of turn foremen, die men, and wire drawers, **James Reed.** The **three Gaspichs, Gus Stern, John Varnola, Chas. Sambol** and his brother **Steve,** the two **Milinichs** and **William McClain,** I find only one that ever left to seek other employment. George certainly had a following; they were loyal to him and he to them. Another Page man is **John Boll,** probably as well known among the wire mills as George Paff himself. In the early days there were a lot of rods sold from that mill, largely by John Boll. The mill has been three-stranded in recent years, and I believe it still sells a good percentage of rod output.

* * *

GEORGE **Paff** was a charter member of the Wire Association, and always its powerful supporter. His willingness and ability to pass on useful hints to the younger generation, plus his ability to couch them in clear and forceful terms, made him one of the best known and best loved of his generation. His death in 1933, while not unexpected, was nevertheless hard to take. He was one of the elder statesmen of the industry, with **Jack Mordica, Walter Stone, Frank Nullmeyer,** and **Clem McGowan.** Only Clem is left now.

* * *

E **H. Peirce,** an old Corporation man, next headed the Wire Mill, to be succeeded by **William Bell,** a Wheeling man, who has recently given place to **H. N. Snowden,** late of Roebling and Seneca. It has seemed to us that the Portsmouth mill rather retired from the world with George Paff's passing. Not that his successors have not been well known and liked, but they never seemed so articulate as George, nor as fond of travel. Oh hell, I guess it's just that we miss George. With **Hank Snowden** I feel that it is going to be different, more like the old times. He is well known, has a wealth of experience to draw on, never has seemed shy about entering into discussions, and is in a spot now where he probably will be glad to keep in touch. This leads naturally to a discussion of the latest turn of affairs at Portsmouth.

* * *

IN 1946 **Cyrus Eaton,** nationally-famous financier and industrial organizer, and a group of associates announced that they had purchased the **Portsmouth Plant** of the **Wheeling Steel Corporation,** and that the new name was to be **Portsmouth Steel Corporation.** The financial structure included an issue of 1,025,000 shares of common stock

at $10.00 a share. Initial sale agreements with Kaiser Frazer and Graham-Page Corporations provided for the production of considerable quantities of slabs and sheet bar to be sold to these concerns. If I have neglected to dwell on the flat side of the Portsmouth picture it is because of lack of space, and because after all this is a wire story. I assume it is generally known that the plant is completely integrated and has a well balanced output.

* * *

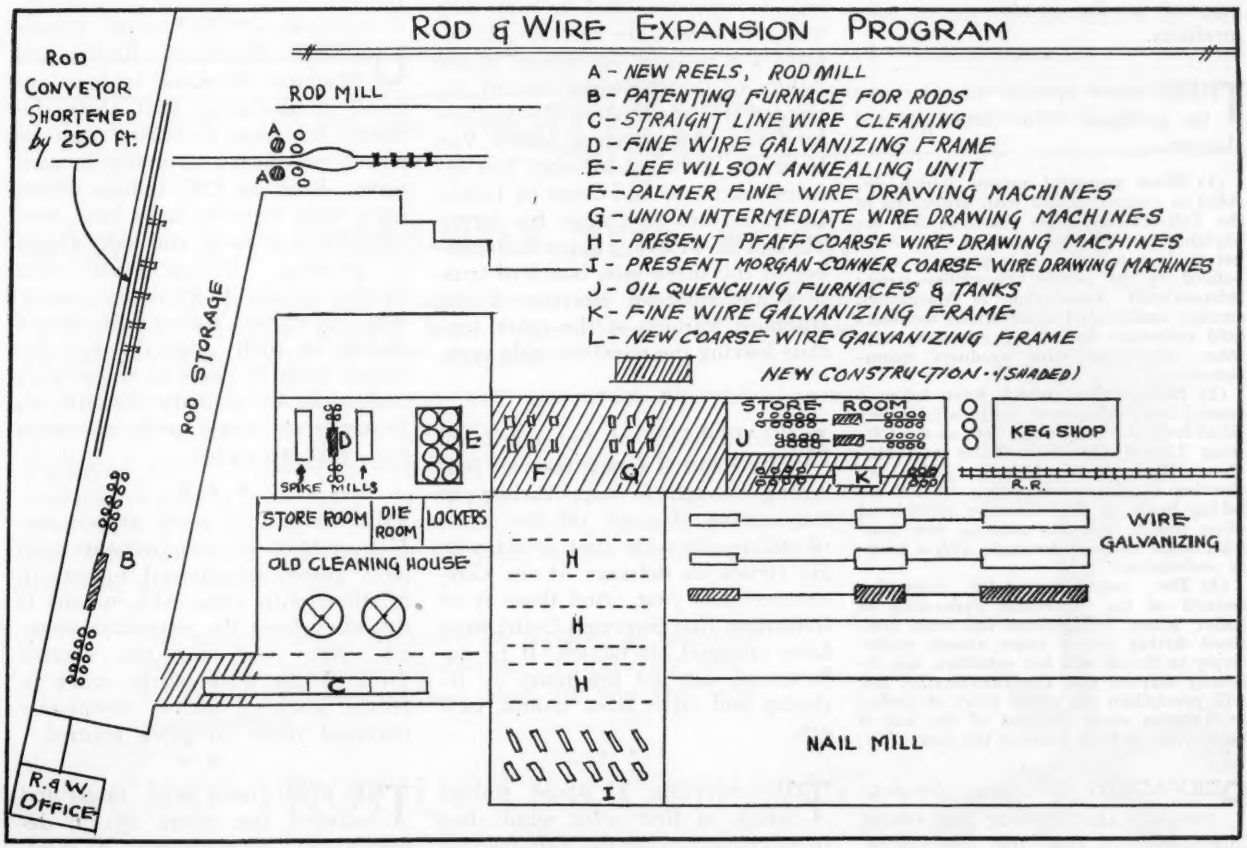
THE removal of the hand sheet mill at Portsmouth in 1937 emphasized the importance of the remaining wire making operations. Emphasis upon wire making recommended itself because of the mill's long experience in the field, the comparatively high value of wire in proportion to its weight, and the growing demand for the product. Under the circumstances it is quite understandable that Cyrus Eaton should have brought to the mill a group of high carbon men to take over and chart a course toward the fine wire, the carbon and alloy wires, and the specialties in general. It is interesting to find the successor of **Burgess Steel & Iron Company** becoming its spiritual heir as well. This mill was of particular interest twenty five years ago as the first common products mill built after there began to be a revolution in drawing equipment. It will be equally interesting as it swings into the new orbit under the experienced hands of **Hank Snowden** and **Uno Johnson**. We all wish it well.

* * *

I have published a layout sketch showing the first steps to be taken to convert the mill. I get a great bang out of this sketch, and I'll tell you why. When the mill was projected it was part of my duty to submit a series of layouts, from which the purchasers selected their favorite. I was always dreaming ahead and I left various open spots of about the right size and shape, so I thought, to permit just the sort of change that is now being undertaken, and it tickles me to see my plans working out so smoothly Especially that straight line cleaning. I had just returned from a second trip to Europe, and had come to the conclusion that straight line cleaning, which was being done rather crudely there, might some day begin to click, and with considerable difficulty I managed to reserve that broad passageway between the rod shed and the wire room which Hank is now adapting to the purpose.

* * *

(*Please turn to page* 266)


ROD & WIRE EXPANSION PROGRAM
ROD CONVEYOR SHORTENED by 250 Ft.
ROD MILL
ROD STORAGE
A - NEW REELS, ROD MILL
B - PATENTING FURNACE FOR RODS
C - STRAIGHT LINE WIRE CLEANING
D - FINE WIRE GALVANIZING FRAME
E - LEE WILSON ANNEALING UNIT
F - PALMER FINE WIRE DRAWING MACHINES
G - UNION INTERMEDIATE WIRE DRAWING MACHINES
H - PRESENT PFAFF COARSE WIRE DRAWING MACHINES
I - PRESENT MORGAN-CONNER COARSE WIRE DRAWING MACHINES
J - OIL QUENCHING FURNACES & TANKS
K - FINE WIRE GALVANIZING FRAME
L - NEW COARSE WIRE GALVANIZING FRAME
NEW CONSTRUCTION - (SHADED)
SPIKE MILLS
STORE ROOM
DIE ROOM
LOCKERS
OLD CLEANING HOUSE
STORE ROOM
KEG SHOP
R.R.
WIRE GALVANIZING
NAIL MILL
R. & W. OFFICE

Line Drawing of the Rod and Wire Mill Expansion at Portsmouth Steel Corporation, Portsmouth, Ohio. * * * * * * * * * *

LABOR RELATIONS

by John B. Stone,
Washington, D. C.

The eleventh o a series of articles on the subject, with particular reference to problems of the wire and wire products industry. The author is a noted authority on the subject.

THE hulking shadow of John L. Lewis, bellicose president and boss of the currently unaffiliated United Mine Workers of America lies across the entire map of U. S. labor relations with an ominous threat of serious trouble to come.

* * *

THE power of Mr. Lewis to shut off supplies of coal to all industry including the manufacturers of wire and wire products is a threat of no mean magnitude itself. But his present revival of mysterious forebodings is accompanied by rapidly worsening labor relations in other fields of vital and immediate interest to the producers of wire products.

* * *

THESE more specific threats may be grouped into three general classes:

(1) Many powerful unions which decided to comply in full with provisions of the Taft-Hartley labor relations law are beginning to wonder whether they have not made a mistake. This group is symbolized by the nearly one-million-strong International Association of Machinists, another unaffiliated union whose members hold collective bargaining contracts with many wire and wire products manufacturers.

(2) Those unions which have taken a frank and belligerent anti-Taft-Hartley stand from the beginning, such as the left-wing United Electrical Radio and Machine Workers of America (CIO) are showing no signs of relenting, in fact are taking heart at the wavering attitude of other unions and are pressing new contract wage increase demands with a deadly seriousness.

(3) The normally stolid executive council of the American Federation of Labor whose belligerence has been confined during recent years almost exclusively to Russia and her satellites, has officially warned that the Taft-Hartley law will precipitate the worst wave of strikes in America since the end of the war if employers seek to enforce the law.

* * *

PERVADING all these developments is the growing fear among labor leaders that the "recession" or "crash" is approaching with a fearsome inevitabilty. Left wing labor economists are now saying in Washington that the "crash" will come this summer or early fall unless the Truman administration is able to stall it off until after the November general elections.

* * *

THE Lewis coal threat, of course, is of utmost importance, if the mine workers' leader means it seriously. The occasion of his warning to operators that he may take whatever means are necessary to enforce the pension agreement is the failure of the three man board appointed to administer the welfare fund to agree on terms. Ezra Van Horn the industry member has refused the terms laid down by Lewis. Lewis refuses to change his terms. Thomas E. Murray, impartial member of the three men board of trustees has resigned because of the stubborn attitude of the other two, thus leaving the question wide open.

* * *

REGARDLESS of the merits of the issue, if Lewis believes it is strong enough to support him he may strike. He set off the wave of strikes after the first world war. He struck in defiance of the Government last year. And there is no indication that Supreme Court fines have changed his tacties. If he believes he can get the jump on industry and other labor unions, he'll act.

* * *

THE wavering of those unions which at first went whole hog in compliance with the Taft-Hartley law is graphically illustrated by the nation-wide complaint of Carl Huhndorff research director of the International Association of Machinists. In a recent statement sent to every member of the huge union he predicted a "complete berakdown of the complicated election machinery of the Taft Hartley law and lambasted Robert Denham, general counsel of the National Labor Relations Board for adding to red tape rather than trying to cut through it.

* * *

THE message was regarded by Washington observers as a palliative designed to soothe growing rank and file unrest and an inclination towards "direct action".

* * *

UNITED Electrical, Radio and Machine Workers leaders are frank in declaring that their demands for wage increases must be met if production is going to continue. Even in CIO unions where right wing victories have been won recently this rank and file unrest is growing. United Automobile Worker locals in Flint are openly rebelling against Walter P. Reuther's change of their original wage demands from 25 cents in wages plus five cents in security benefits, to 15 cents in wages with an extra ten cents insurance.

* * *

PROBABLY of most seriuos import to those managements who have grown accustomed to smooth relations with some AFL unions is the blast from the executive council. Not only did the council threaten the worst strike wave in recent history, but it completely reversed itself on price control.

* * *

THE AFL had been loud and insistant two years ago in demands that price ceilings be abolished.

(*Please turn to page* 260)

GOVERNMENT WIRE PRODUCTION INFORMATION

Government Report on Aluminum Sheathing

SUCCESS in using aluminum instead of lead for sheathing relatively large signal cables is one of a number of practices in the German aluminum fabrication industry described in a report now on sale by the Office of Technical Services, Department of Commerce.

* * *

EVEN though the German aluminum fabrication industry is several years behind its American counterpart the Germans have done much constructive and sound thinking in solving specific production problems, the report states. The report was prepared by Conrad F. Nagel, Jr., chief metallurgist, Aluminum Company of America, Pittsburgh, Pa., and two other investigators, B. C. McFadden and G. C. Welty, who studied the German industry under OTS sponsorship.

LEAD sheathed cable, the report explains, is made by extruding a coating of lead of desired thickness around the insulated bundle of wires. In the process the lead, as it moves through an extrusion press, changes its direction of flow a complete 90 degrees, and while doing so, flows through channels. Because of the very high plasticity of the lead, the change in direction is not a problem. Aluminum, however, is more resistant to plastic deformation.

* * *

GERMAN success in substituting aluminum for lead for this purpose is based, not on new machine designs, the report states, but on the fact that the resistance of aluminum to plastic deformation decreases as the purity of the metal increases, and markedly so when purities of 99.9 percent are reached. The Germans were able to produce aluminum of 99.9 percent purity and use it for sheathing purposes.

* * *

EVEN with metal that pure, the extrusion temperature had to be increased to 450 degrees (C) twice that of lead and this increased the likelihood of damaging the insulation. Therefore continuous extrusion, as with lead, is not employed. Instead a preheated aluminum ingot is placed in the press and extruded. When that is extruded the cable is cut. The maximum single length that can be made is limited by the weight of a single ingot. At the Siemens-Schuckert firm in Berlin a conventional type press is used with total pressure of 3,140 tons. The ingot is 7.87 inches in diameter and 43.3 inches long.

* * *

MIMEOGRAPHED copies of the 31 page report (PB-78274; **Fabrication of Aluminum in Ger-**

TRADE MARK REG. U. S. PAT. OFF. MICRO-WELD MICROMETER PRECISION

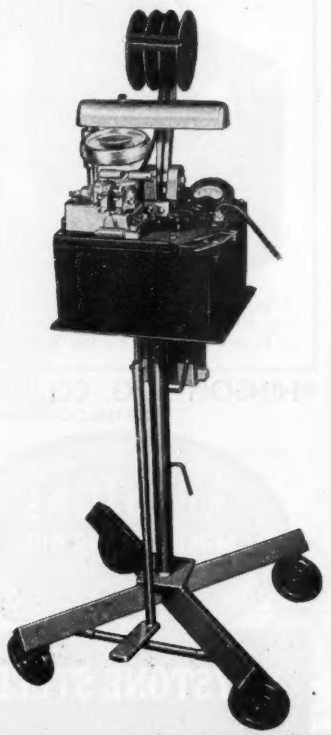
MODEL M-T MICRO-WELD BUTT WELDER

This welder was designed and developed expressly for welding all types of fine wire: Aluminum, Copper, Brass, Bronze, Steel and Steel Alloys, ranging in size from .005" to .020" diameter.

Unit design of frame, transformer and power sub-assemblies permit other range of sizes to suit requirements.

Equipped with a temperature indicating annealing and tempering device, voltage regulator and meter to compensate for voltage fluctuation, wire cutters, extra large 5" diameter magnifying glass, fluorescent light and extension cord. Welder can be supplied for bench mounting, or mounted on 4-wheel truck.

The adaptability of this unit for welding all types of wire, either ferrous or non-ferrous, in sizes from .005" to .020" diameter, make it ideal for the fine wire manufacturer.



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X-ray view of Hinson Pax-Lite bag showing sturdy framework of Keystone Music Spring Wire.

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MUSIC SPRING WIRE
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SPECIAL ANALYSIS WIRE
for all industrial purposes

KEYSTONE STEEL & WIRE CO., Peoria 7, Ill.

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* * *

Reports Available on Wire and Cable Practices

COPPER electric wire was annealed in partial steam in Germany by a novel method and arrangement which saved floor space, required lower processing buildings, and facilitated crane handling according to a report now on sale by the Office of Technical Services, Department of Commerce. The report, prepared by British Intelligence Objectives Sub-Committee investigators, is based on observation and investgation of 10 leading producers and is a general survey of practices used in the manufacture of the principal types of cable and wire.

* * *

FOR annealing in partial steam, the coils of wire are stacked on a base which is suspended in a pot from the pot head by means of suspension straps. After the charge is lowered into the pot, about one litre of water is poured in, and the head is bolted down to it with a circulating water cooled rubber ring which is perfectly air tight. The whole unit is then lowered into an electric furnace, and a further water seal is provided between the lid and the annular space on the top of the furnace into which it fits.

* * *

A small valve on top of the lid which permits air to escape is shut off after sufficient steam has escaped. Annealing temperatures of 250 to 420 degrees C. are used. During the cooling period the pots are filled with producer gas generated from brown coal briquets. For large scale production and acceleration of cooling, the pots are lowered to a basement and set on supports above the floor level. A motor driven fan draws cooling air from gratings on the floor and circulates it around the pots.

* * *

THE report describes another method of annealing in steam,

known as the "wet process", annealing in charcoal and in town gas. Annealing methods for aluminum are also described.

* * *

NATURAL and synthetic rubber core insulation and sheathing materials are described and numerous tables, giving percentages of components of various rubber mixtures are given. Part of the report describes paper insulated power cables and includes information on paper slitting, spiraling, lapping, and drying and impregnating. Lead extrusion presses employed to cover cable with a metallic sheath are described.

* * *

PRACTICALLY all large cable-makers in Germany have a telephone cable factory, the investigators state. A brief outline of processes used is given. The manufacture of dynamo wires, including those insulated with fibrous glass, enamel or lacquer, silk, paper, other textiles such as cotton and rayon, and asbestos, is described.

* * *

MIMEOGRAPHED copies of the 66-page report (PB-75831 **Technical survey of electric cable industry in Germany**) are available from OTS at $2.

* * *

THE following additional reports on electric cable manufacturing are available from OTS:

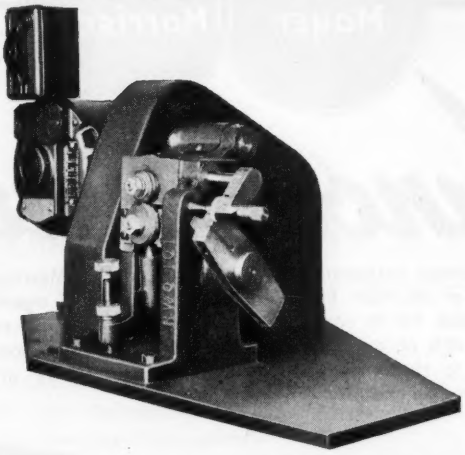
PB-212 (Hackethal Draht Und Kabelwerke A. G., Hanover; mimeographed, 25 cents; 11 pages) gives a brief description of equipment and processes in rolling mill, enameling, rubber and plastics insulating. Hackethal was one of the principal manufacturers of bare and insulated cable in Germany.

PB-304 (Report on Osnabruck Kupfer und Kabel Werke; mimeographed, 10 cents; 3 pages) reports on telephone and telegraph products, especially wire manufacture, rolling, drawing, insulating, quadding or pairing, stranding, and sheathing.

PB-3478 (Report on recent cable development in Germany; microfilm, 50 cents; photostat, $1; 6 pages) describes aluminum sheathing of cables by Siemens-Schuckert Kabelwerke; experimental work by Dr. Walter Ehlers and others on use of polyvinylchmloride (Igelit) which serves as insulator; and a high voltage oil-filled pressure type cable which operates without the usual oil reservoir.

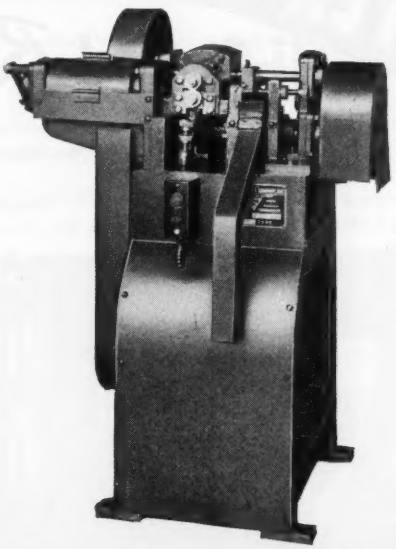
PB-28330 (Investigation of Felton & Guilleaume Kabel Werke, Cologne-Muhlheim; mimeographed, 10 cents; 5 pages) describes insulating with ribbons of paper or styroflex using conventional vertical

TWO NEW MACHINES FOR ULTRA SHORT LENGTHS



The pin cut-off machine above can be set for lengths as short as .050" — in wire sizes down to .006" diameter. This equipment and that shown below meet the increasing demand for machinery to straighten and cut short lengths of wire from a coil.

Glad to quote you on your requirements. When writing, please give maximum and minimum diameter wire and length of cut you intend to make.



This machine cuts heavier wire into short lengths. Other straightening and cutting machines are also available.

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Automatic WIRE STRAIGHTENING AND CUTTING MACHINES

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John R. Morrison

Announcement!

The Carl-Mayer corporation has appointed John R. Morrison (formerly president of Morrison Engineering Corp.) exclusive agent in U.S.A. and Canada, for its complete line of rod and wire bakers. In view of the wealth of experience of Mr. Mayer and Mr. Morrison made available to the wire industry through this exclusive arrangement, we offer to the industry—

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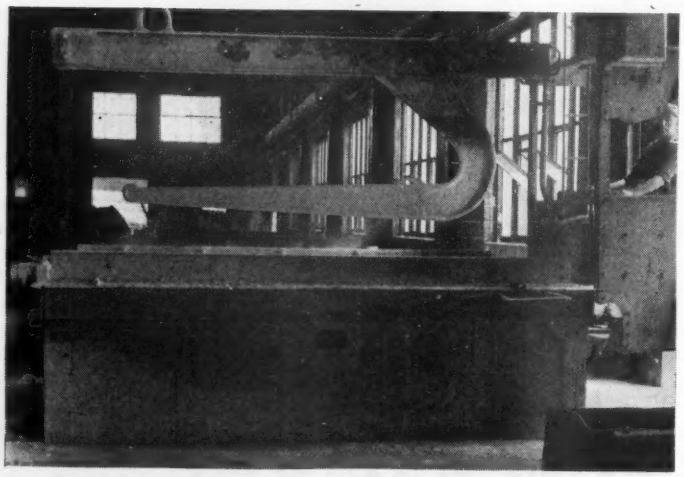
2,296,361	•	2,323,828	364,380	•	396,144
2,235,559	•	1,999,513			401,589



THE CARL-MAYER CORPORATION

3030 Euclid Avenue • Cleveland, Ohio

machines and consecutive pads for three separate coverings. The report contains manufacturing procedure for braiding, and for making of broad band cable suitable for telephone, television, carrier telephone, and radio transmitter cable.

PB-28331 (Investigation of Nord Deutchscher See Kabel Werke at Nordenham; mimeographed, 10 cents; 4 pages) describes manufacture of submarine and land cable, and styroflex material.

PB L-70349 (Various types of insulation for electric cable; microfilm, $6; enlargement print, $84; 837 frames) is a Field Information Agency, Technlical microfilm reel consisting of 23 reports in German from the Kabel & Metallwerke Neumeyer A. G. and pertains to various types of plastics and plasticizers used as insulating for the construction of electric cable.

PB L-10349-S (FIAT Microfilm Reel C 22, Frames 1-837, abstract cards; microfilm, $1; photostat, $2; 23 pages) consists of brief abstracts, in English, prepared by FIAT german abstracters of PB L-70349, above.

PB L-70350 (Insulation used in the construction of electric cables; microfilm, $6; enlargement print, $72.50; 722 frames) is a FIAT microfilm reel consisting of 56 reports, in German, from the Kabel & Metallwerke A. G. and pertains to various types of insulation used in the construction of electric cable.

PB L-70350-S (FIAT Microfilm Reel C 23, Frames 838-1560, abstract cards; microfilm, 2; photostat, $4; 56 pages) consists of brief abstracts, in English, prepared by FIAT German abstracters of PB L-70350, above.

PB L-70351 (The insulation and construction of electric cables; microfilm, $6; enlargement print, $70.50; 704 frames) consists of 112 documents, reports, charts, tables and drawings from the Kabel & Metallwerke Neumeyer A. G. (In German).

PB L-70351-S (FIAT Microfilm Reel C 24, Frames 1560-2264, abstract cards; microfilm, $3; photostat, $10; 139 pages) consists of abstracts, in English, of PB L-70351, above.

PB L-70352 (The construction and compensation of various types of electric cables; microfilm $6; enlargement print, $71; 710 frames)consists of 64 reports, articles and patent specifications from the Kabel & Metallwerke Neumeyes A. G. in the general field of electric cable manufacturing. (In German).

PB L70352-S (FIAT Microfilm Reel C 27, Frames 3654-4364B, abstract cards; microfilm, $2; photostat, $5; 64 pages) consists of abstracts, in English, of PB L-10352, above.

PB L-70353 (The insulation and construction of various types of electric cables; microfilm, $5; enlargement print, $30.50; 301 frames) consists of 35 reports, articles and patent specifications of the Kabel & Metallwerke Neumeyes A. G. in the general field of electric cable manufacturing. (In German).

PB L-70353-S (FIAT Microfilm Reel C 28, Frames 4365-4667, abstract cards; microfilm, $1; photostat, $3; 35 pages) consists of brief abstracts (in English) of PB L-10353, above.

PB L-70354 (Index for FIAT Microfilm C22. C 23, C 24, C 25, C 26, C27, C 28; microfilm, $1.25; enlargement print, $4; 38 frames); contains a brief index (part of t in German) prepared by FIAT German abstracters of the contents of microfilm

C 22 through C 28. Microfilm reels C 25 and C 26 have not yet been received by the OTS.

PB L-79581 (Electric cable, wire insulating and braiding machine industry; microfilm, $1; photostat, $3; 39 pages) reports on the status of German electric cable, wire insulating and braiding machinery manufacture at the close of the war, based on visits to 14 German factories.

* * *

ORDERS for the reports should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order, payable to the Treasurer of the United States.

* * *

IFMA Holds Conference

INDUSTRIAL furnace manufacturers assembled from all parts of the country January 12 and 13 in the largest midwinter meeting of the Industrial Furnace Manufacturers Association since its founding in 1929. The meeting was held in Pittsburgh.

* * *

CHIEF actions taken at the meeting included: a policy on national affairs was adopted for the industrial furnace and oven industry, a plan for judgng future business trends was adopted, job definitions were approved for facilitating the making of wage surveys, and progress reports were made on the several standardization projects. Changes for the improvement of the annual metal show were proposed in a formal report. A new division of the association was organized for the manufacturers of industrial burners, with **Don Campbell** of the burner division of the Bryant Heater Company of Cleveland elected representative of that division on the IFMA Board of Directors.

* * *

PRESIDENT of the Association, **William Adam, Jr.** of the Ajax Electric Company of Phladelphia, pointed out how the advantages of our competitive economic system have made it possible for the industry to produce the most efficient and productive furnaces and ovens in the world.

* * *

THE 18th Annual Meeting of the Association will be held at The Homestead, Hot Springs, Va., May 3, 4 and 5th, 1948.

Announcing the Annual...

WORCESTER REGIONAL MEETING

of the

WIRE ASSOCIATION

To be Held on Friday Evening, April 30, 1948,
at the Sheraton Hotel, Worcester, Massachusetts.

Interesting and timely papers will be presented following the dinner, which is scheduled for 6 P. M., and a motion picture, "Watts in Glass", will be shown after the technical session through the courtesy of the Owens-Corning Fiberglas Corporation.

The meeting will be held under the chairmanship of Rodman R. Tatnall, Metallurgical Engineer, Wickwire Spencer Steel Division, Colorado Fuel and Iron Corporation, Morgan Works, Worcester. A brief address of welcome will be made by LeRoy D. Seymour of John A. Roebling's Sons Co., newly elected President of the Wire Association. Following this two papers will be presented, after each of which questions may be asked.

The first to be presented will be "The Treatment of Waste from Wire Manufacturing Plants, with Special Reference to Pickle Liquors", by Brun J. Queern, Chemical Engineer, Dorr Co., New York, N. Y. Mr. Queern has supervised several such installations in New England and has a practical knowledge of his timely subject.

Following this, A. DiGuilio, Consulting Engineer for the Upton Electric Furnace Co., Detroit, will give a talk on the new method of coating steel with aluminum. This process has stirred widespread interest and is sure to be worth coming to hear.

PLEASE MAIL YOUR RESERVATION CARDS PROMPTLY. MEMBERS MAY BRING GUESTS. PERSONS NOT MEMBERS, WHO ARE ACTIVELY IDENTIFIED WITH THE WIRE INDUSTRY, ARE ALSO CORDIALLY INVITED. WRITE, SAYING YOU WILL BE THERE, SO WE CAN PROVIDE DINNER ACCOMMODATIONS.

We shall hope to see you there!

Tickets, including registration, dinner and meeting: $5.00

THE WIRE ASSOCIATION

Richard E. Brown, Executive Secretary

300 MAIN STREET STAMFORD, CONN.

Note: If you plan to remain overnight, please make your own room reservations direct with the Sheraton Hotel.

Outstanding Personalities of the Wire Industry

Wardwell to Fill New Post for A. S. & W.

A. H. Wardwell has been appointed director of raw materials, a newly-created post, by **American Steel & Wire Co.**, subsidary of United States Steel Corp. Mr. Wardwell, who has been associated with U. S. Steel for 30 years, will be located at the company's general offices in Cleveland and will assume his new duties immediately.

* * *

MR. Wardwell, a graduate of Phillips Andover Academy and Penn State College, has worked his way up through the ranks, having started in 1917 as a pyrometer man in the blast furnaces at the National Tube Company's National Works at McKeesport, Pa. He held other positions before being named superintendent of blast furnaces at the plant in February, 1922. From 1929 to 1935 he was blast furnace and raw material engineer in that company's general offices in Pittsburgh before transferring back to National Works as assistant general superintendent.

* * *

IN September, 1936, Mr. Wardwell was moved to Carnegie-Illinois Steel Corp., another U. S. Steel subsidiary, as assistant to general superintendent at South Works, Chicago. He was named director of industrial relations of Carnegie-Illinois, Pittsburgh district, in March, 1942. Since August, 1946, he has been supervisor of labor relations of that company.

* * *

Western Electric Establishes New Division

WESTERN Electric Company has announced the appointment of **Arthur C. Link**, as Manager of Organization Planning, a new division at Company headquarters, 195 Broadway, New York City.

* * *

IN this post, Mr. Link will report to T. K. Stevenson, vice president-finance, and will undertake continuing studies of fundamental plans of industrial organization and their application to the Company's business so that the necessary activities of all divisions may be so aligned and correlated as to promote the maximum efficiency.

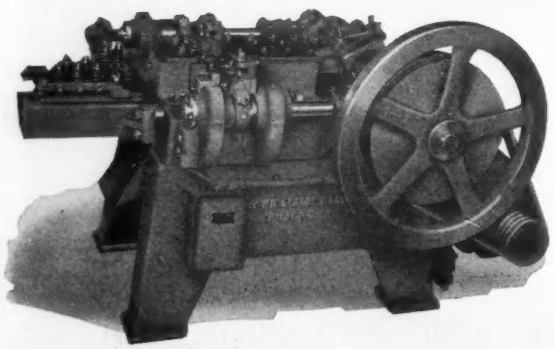
* * *

MR. Link will also consult with division executives in developing and maintaining plans of organization which will best facilitate the management and control of their respective divisions.

* * *

MR. Link brings to his new assignment broad experience in manufacturing and engineering planning. A native of Chicago, he joined

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS
210 No. Racine Ave.
Chicago 7, Illinois
Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

the Hawthorne Works of the Western Electric Company in 1911 as a member of the apparatus drafting division after studying at Northwestern University and Lewis Institute of Technology.

* * *

Barningham Retires from New England Butt

AFTER forty-three years of continuous service to the wire industry, through the **New England Butt Company**, Providence, R. I., **Charles S. Barningham**, formerly chief engineer of the company, retired from active work on January 24th.

* * *

CHARLIE, who resides at 83 Bluff Avenue, Edgewood, R. I., will now have time to pursue a hobby always dear to his heart- . . . boats.

* * *

WE will, along with his numerous friends, miss our frequent business contacts with this amiable and able gentleman, and are wishing him the fullest enjoyment of his greater leisure.

Hartmann Named General Sales Manager

JOHN A. Roebling's Sons Company, Trenton, N. J. manufacturers of wire rope and wire products, through H. C. Low, vice president in charge of sales, announces the appointment of **E. George Hartmann** as general sales manager.

E. George Hartmann, Gen'l Sales Mgr., Roebling Company, Trenton, N. J.

* * *

HARTMANN, who brings to his new position over twenty-nine years experience in the wire field, has been associated with the Roebling Company since 1940.

* * *

WIDELY known in the industry, he is a member of the Wire Association and the American Iron and Steel Institute.

Theodore F. Nessler Named Purchasing Manager of G-E Chemical Department

APPOINTMENT of **Theodore F. Nessler** to a newly created position of purchasing manager for the Chemical Department of the General Electric Company was announced recently by Dr. Zay Jeffries, vice-president and general manager, with the concurrence of Harry L. Erlicher, vice-president in charge of purchasing for the Company. For the past eight years, Mr.

Hi-Efficiency

HMT
ESTABLISHED HUGHESVILLE MACHINE & TOOL COMPANY 1846
WIRE & PROCESS MACHINERY

Standard and Special Equipment for the Wire Industry

STRANDERS • SCRAP BALERS • STRAIGHTENERS
WINDERS • CHEMICAL MIXERS • GRINDERS • COILERS
PROCESSING EQUIPMENT • SPECIAL PURPOSE MACHINERY • PATTERN & TOOL MAKERS

HUGHESVILLE MACHINE & TOOL COMPANY

Hughesville Machine & Tool Co.
54 Academy Street
Hughesville, Pa.
Phone 129A

Thomas S. Hughes
35 Admiral Road
Toronto 5, Ontario, Canada
Phone—Kingsdale 3356

Nessler has been in charge of purchasing of chemicals, castings, factory and foundry supplies for the Company.

* * *

AN employee of General Electric since 1907 when he started his career as a messenger boy in Schenectady, Mr. Nessler has always been a member of the Purchasing Department. Following World War I during which he served with the U. S. Army Engineers Corps in France, Mr. Nessler served as assistant buyer of electrical supplies, lumber and materials for the Company's operations in the radio industry. Since then he has had experience in all other main divisions of the Purchasing Department.

* * *

Eric W. Gundstrom

ERIC William Gundstrom, a former Vice-President and Director of The Wire Association. and for many years active in its affairs, died at his home in Rome, New York January 24, 1948, after an illness of a week.

* * *

MR. Gundstrom was well-known and highly respected in engineering and industrial circles, and especially in the Wire Industry in which he was acknowledged a leader and competent advisor.

Eric W. Gundstrom * * *

HE was born in Hjo, Sweden, May 30, 1889 and was graduated from Orebro College, Sweden. In 1911 he came to the United States and joined the Engineering Staff of the General Electric Company at Schenectady, New York.

* * *

IN 1916 he joined the Rome Wire Company as Assistant Plant Engineer and was affiliated with Rome Wire Company and later General Cable Corporation as Chief Plant Engineer of its Rome plant until 1936, when he became Chief Plant Engineer and Assistant Works Manager of Rome Cable Corporation until his death.

* * *

MR. Gundstrom was very active in his profession and in the community in which he lived. He was a member of the American Society of Swedish Engineers and the Society of National Professional Engineers. He was a veteran of World War I, a member of Rome Chamber of Commerce and a member of Henry P. Smith Post of the American Legion; a member of the Rome Club, Teugeuga Country Club, Rome Lodge 96 B.P.O.E., Hathaway Lodge 369 F. & A.M.

FORTHCOMING MEETINGS of the WIRE ASSOCIATION

Enter these on your calendar and plan to attend

April 16, 1948
Annual Directors' Meeting
and Annual Wire Association Luncheon
at Waldorf Astoria Hotel, New York.

April 30, 1948
Worcester Regional Meeting
Sheraton Hotel, Worcester, Mass.

June 4, 1948
Pacific Coast Regional Meeting
Sir Francis Drake Hotel, San Francisco, Cal.

Timely and interesting programs have been arranged for each meeting.
Watch for announcements in Wire and Wire Products.

Full particulars will be mailed to members.

THE WIRE ASSOCIATION
300 MAIN STREET STAMFORD, CONNECTICUT

THOSE who have attended the meetings of the Wire Association know of the energy and ability he brought to its organization in his service as Program Chairman for several years. He was a man of remarkable energy and ingenuity, an able engineer, a loyal friend and kindly advisor. He will be greatly missed and long remembered by all those whose good fortune it was to know him.

* * *

DuPont Elects New Officers

JANUARY 19th **Crawford H. Greenewalt** became the tenth president of E. I. du Pont de Nemours & Co., while **Walter S. Carpenter, Jr.,** was elected chairman of the Board, it was announced following the regular monthly meeting of the Board of Directors. Mr. Carpenter's resignation as president, and his designation as chairman of the Board, followed the retirement of Lammot du Pont from the latter post. Mr. du Pont's action brings to a conclusion a career in the company that began in 1902, and one that played a large part in the expansion and diversification of the company's activities.

* * *

AT the same time it was announced that **Walter J. Beadle,** a vice president and member of the Board, had resigned as treasurer of the company and had been elected to membership on the Executive Committee. **T. C. Davis,** who had been first assistant treasurer, was elected treasurer to replace Mr. Beadle.

G. E. Chemical Department Makes Appointments

THE appointment of **William B. Frackleton** as district sales manager of the Central District of the **General Electric Chemical Department,** has been announced by Donald S. McKenzie, general sales manager for the department. Mr. Franckleton's headquarters will be at 840 S, Canal St., Chicago, Ill.

* * *

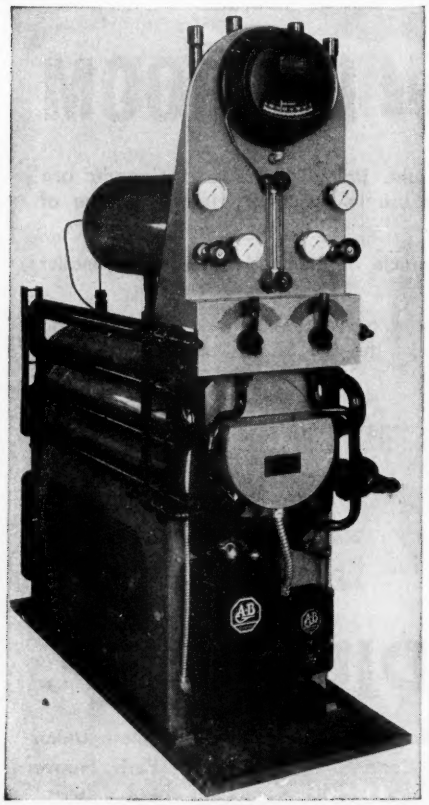
AT the same time, the company also announced the appointment of **Andrew Westead,** as district sales manager for the New England District, to be located at 140 Federal Street, Boston, Mass.

* * *

Philips Appoints New Officers

P. **van den Berg,** who was formerly Vice President and General Manager, has been appointed President of **North American Philips Company, Inc.,** New York, according to a recent announcement by the Board of Directors. Other officers of the corporation are : L. J. Chatton, Vice President and General Commercial Manager; A. Worsnop, Treasurer; T. R. Naughton, Secretary; and L. J. A. van Lieshout, who has just been appointed Assistant Vice President.

* * *



THE ROYLE TEMPERATURE CONTROL UNIT

For Extrusion and Other Industrial Uses

A compact, simply operated unit designed to sustain any pre-determined temperature between 90°F and 475°F. — Hand-lever selection of desired temperature — Heat supplied — or drained — according to operational requirements — Formed piping, elimination of gaskets, and drip pans promote cleanliness — Breakdown of heat transfer oil reduced to a minimum — Three standard sizes 16KW, 32KW, 48KW — Other units with water circulation and refrigeration for operations requiring constantly maintained lower temperatures, 35°F to 200°F.

JOHN ROYLE & SONS ROYLE PATERSON N. J.

PIONEER BUILDERS OF EXTRUSION MACHINES SINCE 1880

London, England James Day (Machinery) Ltd REgent 2430 | Home Office E. B. Trout J. W. VanRiper SHerwood 2-8262 | Akron, Ohio J. C. Clinefelter JEfferson 3264 | Los Angeles, Cal. H. M. Royal, Inc. LOgan 3261

PATERSON 3, NEW JERSEY

A. Vernes has been appointed President of **Philips Export Corporation**, succeeding Mr. van den Berg who now becomes Chairman of the Board. H. G. Noordberg is newly appointed as a Vice President, and F. T. Page as Treasurer. The other officers are: M. M. N. J. Dorenbosch, Vice President, and T. R. Naughton, Secretary.

* * *

NORTH American Philips can avail itself of the full research and engineering facilites of the world wide Philips Industries. It is well known in the television industry and plans to introduce in the Spring a completely new system of projection television known as Protelgram, and featuring a 2½" cathode ray tube, a special optical box, and a high tension power supply which will produce a 12" x 16" picture.

* * *

IN the X-ray field, North American Philips recently announced expansion and consolidation facilities at its Mt. Vernon, New York plant. A full line of medical X-ray apparatus has been developed, together with X-ray equipment for industrial research and other technical applications.

* * *

FINE wire is drawn and tungsten and molybdenum products are made at the company's Lewiston, Maine, plant.

* * *

Institute of Metals Honors Five Men

THE **Institute of Metals of England** has elected two of its members to be Fellows. These are **Cecil Henry Desch**, D. Sc., Ph. D., LL.D., F.R.S., and **Lt. Col. Sir John Henry Maitland Greenly**, K.C.M.G., C.B.E., M.A. These members were honored because of eminent service rendered to the Institute.

* * *

THREE other men have been made Honorary Members in recognition of distinguished services to science or practice of non-ferrous metallurgy. They are: Prof. **Pierre Antoine Jean Chevenard**, Prof. **Sir Geoffrey Ingram Taylor** and **John Fairfield Thompson.**

* * *

M. H. Frommann, Specialty Steel Man, Succumbs

MILTON H. **Frommann**, 49, general superintendent of the Townsend Company, specialty steel manufacturers here, and a Beaver Valley civic leader, died on January 11th at the Beaver Valley General Hospital, following a short illness.

* * *

DuPont Names New Director of Purchases

RETIREMENT of **Ernest H. Hawkins** as Director of Purchases of the Du Pont Company, and appointment of Thomas W. Harris, Jr., to succeed him, was announced recently.

* * *

DIAMOND POWDER FOR THE DIE ROOM

More and more die rooms throughout the United States and Canada are switching to UNION diamond powder for use in recutting. Here are some of the reasons:

1. PERFECT GRADING — Not a single particle of diamond is larger or smaller than the grade limits allow.

2. Where to end one grade and start the next is determined not by broad general industrial usage but by requirements of the DIE ROOM only.

3. Only top-quality new boarts are used.

4. The reputation of UNION for providing first-rate products at a fair, sensible price.

Write for our diamond powder bulletin.

DIAMOND DIES **DIAMOND POWDER** **RECUTTING MACHINERY**

THE UNION WIRE DIE CORP.

24 Gore Street, Hamilton, Ontario
71 West 45th Street, New York City 19
375 Fairfield Ave., Stamford, Conn.
La Filiere Union, Paris, France

AS head of the company's Purchasing Department, Mr. Hawkins was responsible for the expenditure of millions of dollars annually for raw materials, fuel, power, equipment and supplies. He joined the company in 1917. Mr. Harris has been Purchasing Agent since 1945.

* * *

J. Edward Donnellan Joins Staff of Wire and Wire Products

THE publishers of **WIRE AND WIRE PRODUCTS** take great pleasure in announcing the addition of **J. Edward Donnellan,** widely known throughout the metal working industry, to its staff as of March 1, 1948.

* * *

MR. Donnellan brings a wealth of ability and experience to our organization that will enable us to increase our many services to the wire industry. He has been perhaps best known for the twenty years of work in the metal field with the American Society for Metals, whose staff he joined in 1924. He played an active part in the staging of the National Metal Exposition and was for many years

J. Edward Donnellan

the editor of the Metals Handbook. In 1944 he became vice-president in charge of sales for the General Alloys Company of Boston.

SINCE his graduation from Pratt Institute in Brooklyn as an industrial chemical engineer, he has been directly associated with the metal industry continuously, having been with the New Departure Manufacturing Company and the Holcomb Steel Company before his identification with the Society.

* * *

WE know that his hosts of friends will be glad to learn of this important step in Mr. Donnellan's work and will join with the publishers of WIRE AND WIRE PRODUCTS in wishing him a large measure of success.

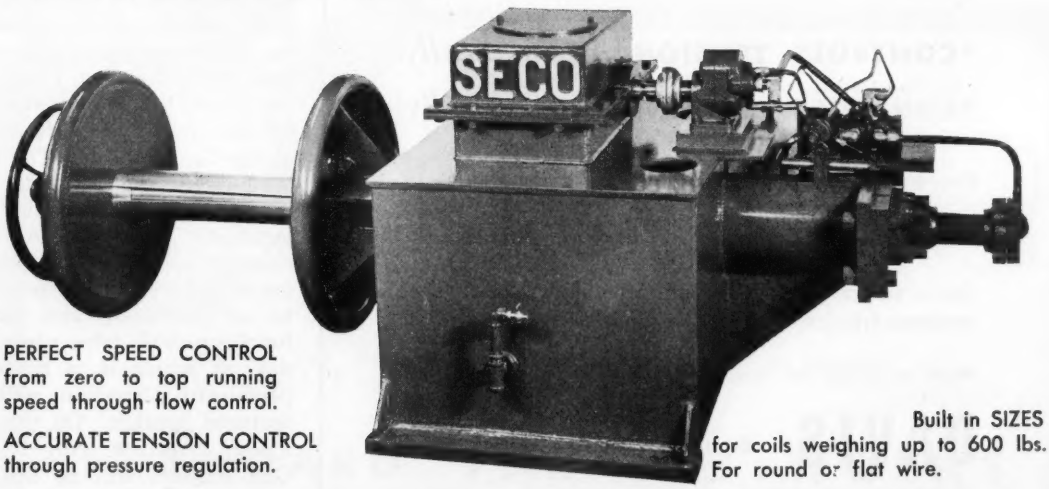
* * *

Norton Company Appoints New Vice-President

W. F. **Gow,** director and works manager of **Norton Co.** abrasive division, Worcester, Mass., **has** been elected to the new post of executive vice-president. **John Jeppson,** assistant secretary and foreman, has been made a director.

TRAVERSE REELS *Hydraulically* OPERATED

WIRE SPOOLERS, Single & Multiple Type



PERFECT SPEED CONTROL from zero to top running speed through flow control.

ACCURATE TENSION CONTROL through pressure regulation.

Built in SIZES for coils weighing up to 600 lbs. For round or flat wire.

STEEL EQUIPMENT COMPANY

2890 East 83rd Street F. JULES KELLER, *President* Cleveland 4, Ohio

New Materials Handling Film Shown to Press in New York

IN a premier showing of a film entitled "Trans-Triplets", the **Automatic Transportation Company** of Chicago, Illinois, nicely demonstrated a graphic illustration of the practical advantages of motorized materials handling. The "Triplets" are the Company's line of Transporters, Transtackers and Transtractors.

* * *

THE new film is a two-reel, 18-minute, black-and-white, sound pictorial study of materials handling methods and operations which can be done most efficiently by the "Trans-Line", evolved from the original Transporter which first shifted the burden of moving hand trucks from human muscles to electric power.

* * *

EQUIPMENT presented in the film includes platform and pallet-type Transporters moving skid and pallet loads, respectively; Transtractor and trailer-train; and platform and pallet-type Transtackers tiering and hauling skid and pallet loads, respectively.

PRIOR to the showing, **Elmer F. Twyman,** General Manager of the Automatic Transportation Company, gave a short talk in which he described materials handling as the last frontier for reducing costs and thereby offsetting rising costs of labor and material. He stated that approximately 80% of all unskilled labor is employed in the handling of materials and that 22% of all labor costs in manufacturing are in materials handling. If all industries, he said, were to modernize their materials handling methods, an overall average price reduction of 10% would become a definite possibility.

* * *

THIS new film, a sequel to previous movies produced by the company, is available for group showings.

* * *

A.G.A. Spring Conference

THE annual A. G. A. Sales Conference on Industrial and Commercial Gas will be held this year in Windsor, Ontario, Canada, April 7, 8 and 9, according to the announcement by Leon Ourusoff, Chairman, Industrial and Commercial Gas Section, **American Gas Association.**

* * *

AN outstanding program has been prepared by the Section's Program and Papers Committee under the Chairmanship of Harry A. Sutton. Following last year's pattern, the three-day Conference will be divided to cover different phases of the Gas Industry. The first day, Wednesday, April 7, will be given over entirely to Industrial Gas subjects. On Thursday, April 8, the morning and afternoon sessions will cover subjects of general interest to all gas men, and the formal luncheon will take place on that day, at which it is hoped that a prominent Canadian will be the featured speaker. On the last day, Friday, April 9, only Commercial Gas subjects will be discussed by the speakers. Tentative plans call for some committee meetings during the Conference which will be arranged so that they will not interfere with attendance at sessions.

* * *

DAVIS PAY-OFF-STAND

*CONTROLS TENSION *Automatically!*

*CONTROLS BRAKING *Automatically!*

Prevents over-travel and wire breakage!

Stops instantaneously when winding spool stops!

Davis self-aligning ball bearing pillow block reduces friction!

Write us today for complete information . . .

DAVIS *Equipment for the Wire Industry*

SPARK TESTERS • SPOOLERS • TAKE-UPS • CAPSTANS

The R. L. DAVIS ELECTRIC CO., INC., WALLINGFORD, CONN.

A Review of Recent Wire Patents

No. 2,434,073, METHOD AND APPARATUS FOR MAKING INSULATED CABLE, patented January 6, 1948 by Hans D. Isenberg, Wilmette, Ill.

This apparatus winds a helically-formed insulation, but there is provided a device for so controlling the formation of the convolutions that certain thereof are radially displaced from the wire conductor and the other convolutions engage the wire conductor at spaced points along its length to support those convolutions from the conductor. Adjacent helical convolutions are moved towards each other to form a continuous sheath surrounding the conductor.

* * *

No. 2,434,209, DEVICE FOR INSERTING SPRINGS IN POCKETS, patented January 6, 1948 by Harold P. Glazier, Detroit, Mich., assignor to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware.

The machine is adapted to insert a coil spring in a side-opening pocket and comprises a pair of delivering fingers over which the pocket is insertable, the uppermost finger having on its under side, a frictional surface for offering resistance to the movement of the top coil of the spring, the lowermost finger being longer than the upper finger and having an upturned end to aid in forcing the bottom turn of the spring upwardly so as to have the spring ejected with its axis horizontal.

* * *

No. 2,434,286, METHOD OF FORMING A POINT AT THE END OF A WIRE, patented January 13, 1948 by William G. Pfann, Summit, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

For shaping an electrical contact wire, the inventor immerses one end of the wire below the free surface of an aqueous solution of potassium hydroxide to form a meniscus at the surface of the solution, applies an electrical potential to the wire to cause the etching thereof by electrolytic action and the formation of a symmetrical point in the region of this meniscus, and adding a soluble copper compound to the solution for the purpose of sustaining the meniscus while this symmetrical point is being formed.

* * *

No. 2,434,382, RESILIENT MATTRESS FOR SEATS, CUSHIONS, OR OTHER APPLICATIONS, patented January 13, 1948 by André Auby, Puteaux, France, assignor to Société a responsabilité limitée Etablissements Bertrand Faure, Puteaux, Seine, France.

Interlacing of the wire coils is provided by a continuous wire strand bent into a series of circular loops and adapted for interlacing the coils of adjacent rows.

* * *

No. 2,434,591, COIL-WINDING APPARATUS, patented January 13, 1948 by Lawrence R. Hill, Wilkinsburg, and John J. Keyes, Edgewood, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania.

A wire coating wiping device is disclosed for controlling the amount and distribution of the coating.

* * *

No. 2,434,591, COIL-WINDING APPARATUS, patented January 13, 1948 by Cyril L. Schaefer, Chicago, and Nils H. Swanson, Zion, Ill., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This apparatus comprises a rotary mandrel for supporting a core, a wire delivering sheave, a reciprocating wire skinning device positioned coaxially with respect to the wire intermediate the sheave and mandrel, and a second device operable for engaging the skinning device with the wire and for rotating the skin-

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

ADVANTAGES WORTH CONSIDERING

When in the market for cable lacquers, insulating finishes, or impregnating compounds, consult us and have at your command:

1. SPECIALIZED RESEARCH EXPERIENCE
2. RECOGNIZED AND WELL EQUIPPED LABORATORIES
3. SUCCESSFUL PERFORMANCE RECORDS
4. CONFIDENTIAL TEAMWORK

and

5. 77 YEARS OF KNOWING HOW

Our Hot Melt, *Flame Resistant, Non-Toxic* Compounds are accepted for AF and CF wires.

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STANDARD VARNISH WORKS

Engineers of Product Finishes

NEW YORK — LINDEN, N. J. — CHICAGO

Serving Industry For 77 Years

ning device about the wire during reciprocation of the skinning device for removing insulation from the wire.

* * *

No. 2,434,640, MACHINE FOR STRIPPING COVERED CABLES, patented January 20, 1948 by Howard A. Burdwood, Portland, Maine.

The assembly comprises a pair of shafts with a wire feeder mounted on one and a cutter at the sides of the feeder, the cutter making two continuous cuts through the wire cover tangentially to the core thereof.

* * *

No. 2,434,793, ELECTRIC CORD, patented January 20, 1948 by Edward B. Feaster, Springfield, Mass.

For electrical appliances, this cord comprises a bodily flexible insulating sheath having a number of conduits extending longitudinally thereof, a flexible wire conductor located within each conduit and of a length greater than that of the conduit, each conductor being sealed to the sheath at each end of its conduit, and a relatively non-extensible reinforcing member extending from one end to the other of the sheath, symmetrically positioned with respect to the conductors, and secured to the sheath at its ends, so that the cord may be flexed laterally without imposing strain on the wire conductors.

* * *

No. 2,434,881, ABRASIVE CLEANING SYSTEM, patented January 20, 1948 by Gilbert D. Dill, South Bend, Ind., assignor to American Wheelabrator & Equipment Corporation, a corporation of Delaware.

More specifically, this is a device for starting a strip or the like through a sand blasting machine.

* * *

No. 2,435,093, ELECTRICAL INSULATION, patented January 27, 1948 by Melville F. Mitschrich, St. Louis, Mo.

Wire coil insulating wrappers are disclosed, comprising a multiply band of insulating strips, these strips being anchored together at a local point and being marginally slitted, the slits in each layer being staggered with respect to the slits in an adjacent layer.

* * *

Army to Lay Field Wire with Rockets

THE use of rockets to lay light field telephone wire by means of an improved type wire dispenser was proved practical in recent tests at Fort Dix, N. J.

* * *

SIGNAL Corps engineers say that in emergencies the projectiles might be fired without a launcher. The rocket, in its cardboard packing case, can be fired from a wedge-shaped hole in the ground, laying out the wire to distances up to 150 yards.

* * *

THE method has a distinct advantage in the simplicity and portability of the equipment required. One man equipped with a wire dispenser, a small field telephone and a rocket can establish wire communication for relatively short distances over rivers, ravines and other obstacles.

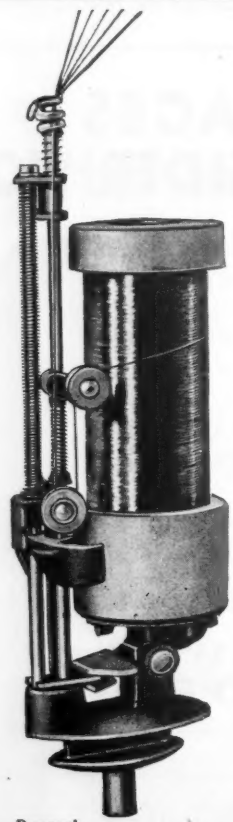
* * *

THE wire dispenser employed in the tests is a version of one developed during World War II, by which wire in coil form could be paid out by bazookas or rifle grenades or laid by airplane or moving vehicles.

* * *

A new communications wire, called infantry wire, was used in the test. It provides a talking range equal to that of field wire, but its weight about one-third that of field wire.

* * *



Patented
2 BX - Special
MOSSPEED Carrier.

MOSSPEED BRAIDER CARRIERS
FOR BRAIDING
MULTIPLE ENDS OF FINE WIRES

A special design MOSSPEED CARRIER and BOBBIN is supplied for braiding "SHIELDED" WIRE, ETC.

Will braid multiple ends of aluminum, brass, bronze or copper wire, etc.

TWO SHEAVE-WHEELS and SPECIAL-TOP-THREADEYE on carrier, together with new type BOBBIN provides an even wire "let-off" resulting in a high quality and uniform braided shield.

Consult our engineers regarding your braiding problems

MOSSBERG
Pressed Steel Corp.
18 WEST STREET
ATTLEBORO, MASSACHUSETTS, U. S. A.

European Agent
James Day (Machinery), Ltd., "Ford House," 88 Regent Street, London, W. I., England.

Neoprene Goes Underground

AMPLE supplies of lead have been exceedingly difficult to obtain in recent years. And the scarcity of this metal could have placed a serious handicap on manufacturers of wire and cable. And it did, for a time. For lead has been extensively used in this industry as a jacketing material for underground cable. The practice of laying cable below ground has been gaining, so demand for cable suitable for this service has been increasing steadily. Fortunately, the wire industry did not come up to this emergency unprepared. When they realized supplies of lead would be short, progressive manufacturers instituted testing programs in a search for a material that could take the place of lead.

* * *

OF the many materials that were tested, neoprene was selected as the most promising. Neoprene had already proved outstanding as a jacketing material on many types of wire and cable, but principally for service above ground. How well it would perform below the earth's surface, where conditions are entirely different, was questionable. To find out, sample cables were made with specially compounded neoprene jackets and special insulation, then tested under every conceivable condition that would be encountered in underground service. The new cable proved so successful in these rigorous tests that it was recently announced to the electrical industry.

* * *

THE neoprene jacket on cable is tough and resilient; it is not easily cut, dented, crushed or torn. This resistance to mechanical damage is of utmost importance for cable which is to be buried directly in the ground. The earth, above and around the cable, in the first year of service, is in a state of constant movement and adjustment and exerts considerable crushing, and often times cutting force, which neoprene withstands very well.

* * *

THE protection provided by neoprene is permanent, since neoprene won't rust or rot, and is not affected by galvanic action or the corrosive effects of acid or alkaline soil. And its resiliency enables it to absorb shocks from vibration, a common cause of failure in lead sheath, even when it had the special extra protection of steel tape, asphalt or tar. Vibration, particularly strong in underground installations near railways and under pavements where traffic is heavy, is absorbed without damage to the cable.

* * *

THE neoprene-jacketed underground cable is easy to install, especially when laid in ducts. It is light and flexible and its smooth jacket is highly resistant to abrasion. When installed in ducts, manufacturers claim that no lubricants are required to pull the neoprene-jacketed cable through ducts. But, if preferred, the cable may be dusted with mica, soapstone, coated with a soap solution, or lubrication may be obtained by flooding the conduit with plain water.

* * *

The SPECIALISTS in
Wire - Straightening and Wire - Cutting!

Diameter Range — 1/16" to .005"

PRECISION - Our Motto

DON'T hesitate to call on us when you are confronted with wire-straightening problems involving close tolerances and absolute accuracy. For seventeen years we have specialized in straightening and cutting all gauges of fine wire, hard or soft, ranging in diameter from one-sixteenth of an inch down to five-thousandths of an inch. We employ gun-barrel accuracy in straightening lengths from one inch to ten feet or any fractional part thereof. Ends cut absolutely clean without burrs.

ASK ABOUT OUR UNEXCELLED FACILITIES FOR CLEANING AND POINTING WIRE ALREADY STRAIGHTENED AND CUT.

ALL TYPES OF WIRE...

- Nickel
- Stainless Steel
- Bronze
- Brass
- Copper
- Alloy Wire
- Music Wire
- Tag Wire
- Florist Wire

Write us today!

Manufacturers of the famous ARMA PAPER CLIP

PITTSBURGH CUT WIRE COMPANY
1112-20 GALVESTON AVENUE · PITTSBURGH, PENNSYLVANIA.
TELEPHONE: CEdar 4702

THE new cable offers another very important advantage to electrical engineers, for neoprene is as much at home above ground as it is in the ground. It resists sun checking, weathering, oxygen and ozone. These properties plus its ability to withstand destructive forces below ground level, make it an ideal jacket for an all-purpose cable. Thus it should be particularly useful to those concerned with rural electrification where both underground and overhead installations may be required on the same line.

* * *

Southern Machinery and Metals Exposition

THE Third Southern Machinery and Metals Exposition returns again to the heart of the South with the newest developments in equipment, supplies, and machinery. It will be held at the Atlanta Municipal Auditorium in Atlanta, Georgia, April 5-8, 1948, and will occupy three floors.

* * *

LAST year's Exposition which drew more than 7,500 from throughout the South, stamped this event as a focal point of contact between manufacturers and Southern industry. Leading Southern plant owners, managers, production officials, financial executives, purchasing agents, superintendents and foremen have already indicated their plans to attend this concentrated showing of industrial products from all over America.

* * *

FOR immediate information, exhibit space and hotel registrations, address: Michael F. Wiedl, Managing Director, Southern Machinery and Metals Exposition, 267 E. Paces Ferry Road, N. E., Atlanta 5, Georgia.

* * *

New Small Metallizing Gun Announced

ONLY ten cubic feet of air per minute for metallizing. This, the outstanding feature, is one of many new features of the new "Light Duty-Low Air" L Gun just announced by the **Metallizing Engineering Co., Inc.**

* * *

THIS new gun uses a new turbine construction requiring only one-third the power, making a large compressor unnecessary. The nozzle construction assures lower cost per pound of metal sprayed because of the low consumption of acetylene and oxygen. Another feature — turbine control — requires only one adjustment for the entire range of metallizing wires. The gun weighs only 4 lbs. 2 oz., considerably lighter than previous models.

* * *

AN illustrated bulletin has been prepared, copies of which are available on request to **Metallizing Engineering Co., Inc.**, 38-14 30th Street, Long Island City 1, New York. Ask for Bulletin 55.

* * *

THE WIRE ASSOCIATION takes pleasure in announcing

THE SAN FRANCISCO REGIONAL MEETING

ON JUNE 4, 1948, AT THE SIR FRANCIS DRAKE HOTEL.

The meeting will start with dinner at 6 P. M. and will feature two excellent papers of timely interest. Earl R. Potter of Industrial Wire Products, 2417 17th Street, San Francisco, Calif., will serve as chairman. In the afternoon preceding the meeting, there will be a Plant Inspection Trip to the wire mill of Columbia Steel Company. Those who plan to attend the meeting can go on this tour. Information can be secured from Mr. Potter.

Technical papers will be presented by Harold L. Trembicki of the Magnus Chemical Company, Garwood, N. J., which will cover the use of wire coating compounds, and by Herbert B. Clark, Vascaloy-Ramet Corp., North Chicago, Ill. His subject will be "Powder Metallurgy", a question on which all wire men should keep informed.

The N. A. M. will furnish a speaker on economic conditions and at the close of the meeting, an industrial motion picture, "Watts in Glass", will be shown through the courtesy of the Owens-Corning Fiberglas Corp., Toledo, Ohio.

ALL PACIFIC COAST WIRE MEN ARE URGED TO ATTEND

Write the Chairman or the Executive Secretary for reservation cards.

You will have a good and profitable time.

THE WIRE ASSOCIATION

RICHARD E. BROWN, Executive Secretary

300 MAIN STREET STAMFORD, CONN.

Tickets: $5.00 each.

New Booklet "Injury in Ground Surfaces"

A new booklet, published by Norton Company, is the most up-to-date and complete treatment available of the subject "Injury in Ground Surfaces". Dr. L. P. Tarasov of the Norton Research Laboratories is the author.

* * *

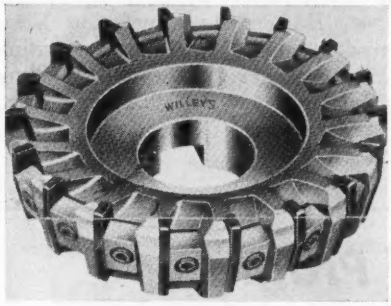
THIS booklet features many photographs which show clearly the numerous types of defects, such as cracks and burn, that are sometimes found in ground surfaces. Above all, it is written for people concerned with the practical aspects of grinding. Makers of tool steel, tools, dies, and hardened steel parts, are finding the information contained in the booklet to be directly helpful in their everyday work.

* * *

THIS publication should appeal to metallurgists having to deal with these problems since it presents in detail the latest information on the detection of injury and how to proceed in trouble shooting.

New Axial Face Mill Announced by Willey's Carbide Tool Co.

THE new Axial Face Mill, for cast iron, just announced by **Willey's Carbide Tool Co.** of Detroit, is a precision built, permanent tool designed to handle straight facing and heavy roughing cuts. It can be used for finish milling also, and in many cases the two operations can be combined.



Willey's Carbide Tool Company's New Axial Face Mill.

* * *

THE blades are of solid carbide, stocked in grades E5, E6 and E8, accurately ground on the three sides that contact the side wall, the bottom of the slot and the wedge. They are interchangeable and adapted to either right or left hand operation.

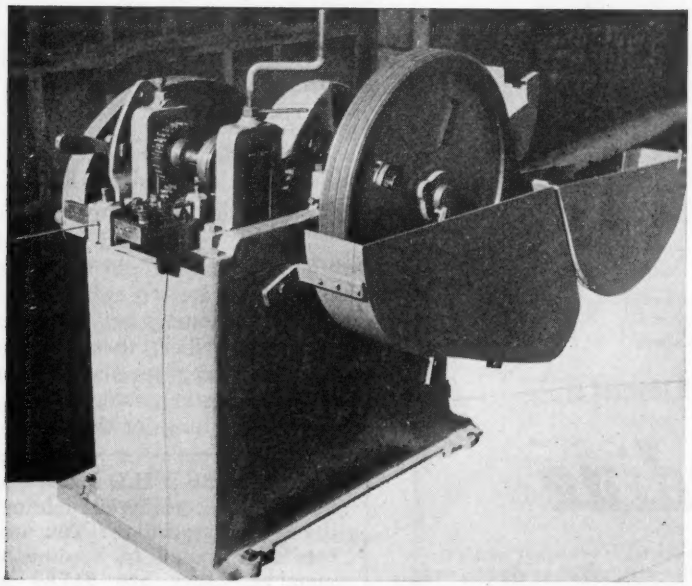
* * *

THE large number of carbide blades provides a wide distribution of work which results in longer runs between grinds and an effective increase in the rate of feed, which means more production per hour.

* * *

WILLEY'S Axial Face Mills are manufactured in 6 sizes, cutter diameters ranging from 4¼" to 14", having from 8 to 28 blades. They are available in both WI and WN mountings. Illustrated literature, with complete specifications will be mailed promptly upon request.

* * *



MOST RAPID STAPLE CUTTER EVER MADE

MAKES FENCE STAPLES — POULTRY NETTING STAPLES — DOUBLE POINTED TACKS

Moderately priced — Belt or motor driven.

Write for full details of HUMPHREY RAPID FENCE STAPLE MACHINE.

Prompt deliveries now possible.

Manufactured Exclusively for:

REED and RICHARDS TRANSATLANTIC, INC.

CHANIN BLDG., 122 EAST 42nd ST., NEW YORK 17, N. Y., U.S.A.
REG. CABLE ADD.: "LOUREED, NEW YORK".

Wire Bale Tie Machines, producing single loop, round or oval ties, 2000 per hour; 3 to 16 ft.

New P&H "Hartop" Hard-Surfacing Electrodes

A new group of hard-surfacing electrodes is announced by **Marnischfeger Corporation**, Milwaukee, manufacturer of P&H welding products.

* * *

NAMED "Hartop" there are four electrodes in this new P&H series: Brown, Green, Red and Yellow. They cover the Rockwell C range of from 35 to 63 (as deposited).

* * *

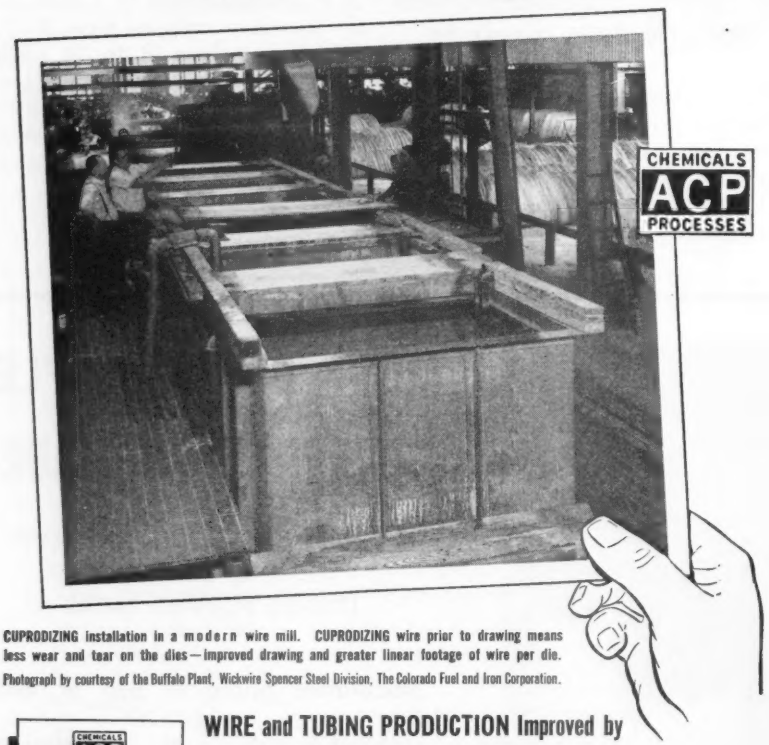
A feature of all four of these P&H electrodes is their easy, stable arc. Operators do not have to fight to hold an arc; there is no sputtering or hum. Weld metal flows quietly and smoothly. Cleaning of Hartop welds is not required as there is no slag to remove.

* * *

COMPLETE information on P&H Hartop Hard-Surfacing Electrodes can be obtained by writing Harnischfeger Corporation, Welding Division, 4400 W. National Ave., Milwaukee 14, Wisconsin.

* * *

Picture of Progress



CUPRODIZING installation in a modern wire mill. CUPRODIZING wire prior to drawing means less wear and tear on the dies—improved drawing and greater linear footage of wire per die. Photograph by courtesy of the Buffalo Plant, Wickwire Spencer Steel Division, The Colorado Fuel and Iron Corporation.

CHEMICALS ACP PROCESSES
RUST PROOFING AND PAINT BONDING
Granodine *
Duridine *
Alkodine *
Lithoform *
Thermoil-Granodine *
RUST REMOVING AND PREVENTING
Deoxidine *
Peroline *
PICKLING ACID INHIBITORS
Rodine *

WIRE and TUBING PRODUCTION Improved by

Cuprodine*

"Cuprodine" deposits a thin, adherent layer of copper on steel—that reduces scratching and wear on dies, prolongs die life, and promotes a greater linear footage of drawing per die. It works effectively on Stainless, as well as on carbon steels.

A simple speedy immersion process, without electricity—"Cuprodizing" is the modern, economical answer to your drawing problems.

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

New Booklet Shows Wire Rope Manufacture

A nicely gotten up booklet, "Life-Line", shows the various processes of manufacturing wire rope from wire rods through wire and wire and rope mills. The story is presented in pictures with short captions in a similar manner to a strip film. The booklet contains 56 pages.

* * *

THE manufacturer states that this booklet, Number 48-1 is obtainable on request to any Macwhyte distributor, branch office or by writing to **Macwhyte Company**, Kenosha, Wisconsin.

* * *

New Ross Industrial Oven Bulletin

J. O. Ross Engineering Corporation, New York, N. Y. announces its new Industrial Oven Bulletin #132. The bulletin illustrates 55 different types of Ross industrial ovens including, among others, Lithograph Ovens, Core Ovens, Weld Rod Ovens, Wire Bakers, Automobile Body Ovens, etc. Factors covered are: Oven construction; Method of heating; Source of Heat; and Material Handling. 24 pages and fully illustrated. Copies may be obtained by writing to J. O. Ross Engineering Corporation, 350 Madison Ave., New York 17, N. Y.

* * *

Bulletin on Carbide Dies

THE Carboloy Company, Detroit, Michigan, has issued a bulletin entitled, "Why Not?", in which they list and illustrate ten extra services that their customers get when buying Carboloy dies, these "extras" going with every purchase. Copies of this interesting folder may be secured by writing for them.

TO WIRE MILL MEN

Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $15.00 a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.

THE WIRE ASSOCIATION
300 Main Street,
Stamford, Conn.

The Problem of Metallic Corrosion E. Jimeno, Published by the Spanish Navy Department, Institute of Oceanography, Madrid, 1947.

El problema de la corrosión metálica. — Emilio Jimeno, Ministerio de Marina, Instituto Español de Oceanografía, Madrid, 1947.

DR. Jimeno has written a unique book on metallic corrosion in Spanish. Corrosion does not discriminate between a highly industrialized nation such as the U.S.A. and one that is not. What mostly distinguishes a modern country from the little-advanced ones is that in the latter, they do not know or do not use metals. The scientist, the engineer and the student must be aware of corrosion. The metallurgist does not know as yet the fundamental reason for the behavior of metals. Therefore, corrosion remains a controversial subject.

* * *

THE author, as an educator presents his thesis that the training of a chemist, or of an engineer, should be such that the man has a thorough knowledge and understanding of the fundamental principles of the sciences; a curiosity should be aroused in him which will help him in developmental research, trouble shooting, and other engineering endeavors.

* * *

MANY of the difficulties technically trained men encounter in their profession are due to the fact that they do not entirely understand the basic principles of their profession. Frequently, a technically trained man performs experiments and tries to figure the thing out afterward. If he were to think first and experiment afterward to check his reasoning, many failures would be avoided.

* * *

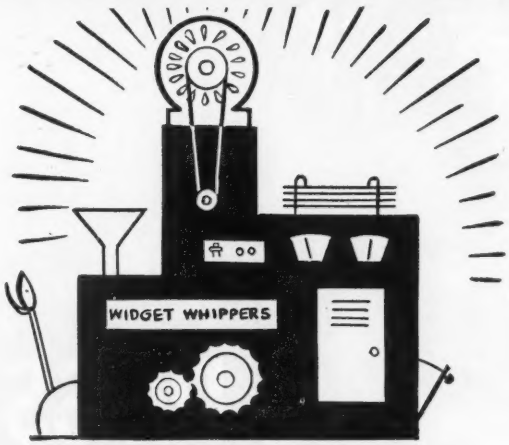
THE purpose of the book is to present the known fundamental knowledge on corrosion, a summary of world-wide experience with corrosion and an outline of the various methods of protection. The objectives are well accomplished in the 240 pages of the book, and it should be of interest and use to all Spanish-speaking people interested in or annoyed by the various types of corrosion of metals under miscellaneous conditions.

* * *

AFTER a short presentation of the importance of metallic corrosion, a brief discussion is given of theories up to and including the electronic theory. Corrosion as a chemical phenomenon and as an electrochemical one are discussed, considering in detail electrode potentials, galvanic cells and polarization. In addition to the corrosion at room temperature, the effect of humidity and oxidation are reviewed. Surface films, corrosive agents and types of corrosion are discussed, particularly intercrystalline corrosion, corrosion fatigue, and corrosion by animal and vegetable growths so common in many harbors and rivers. The experience gained by individuals and institutions in many countries is summarized for the various subjects discussed, and the author adds his personal experience in this field.

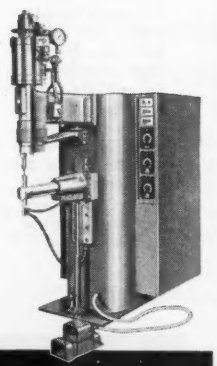
* * *

Whether you make Whippers



. . . or pots and pans, or trucks, or stoves, or any product fabricated of metal . . . you'll be interested in the story of Mr. Widget. He was faced with the dilemma of wanting to use resistance welding but not having sufficient plant transformer and distribution facilities to handle the extra load. Also the power people frowned on the addition of a *low power factor* load.

How Mr. Widget became a "Man of Success" with the aid of "THREE PHASE" is briefly told in the booklet; "How Mr. Widget Made More Whippers." Your copy is waiting—just drop us a post card. You'll find it well worth the 3 minutes reading time (not counting technical stuff.)



Manufacturers of a complete line of resistance welders. Offices in New York, Detroit and Dayton. Representatives in Principal Cities

SCIAKY

SCIAKY BROS. Inc., 4923 WEST 67th STREET, CHICAGO 38, ILL.

IT is of interest that before the XVI century most of the best constructional forged iron was made in Spain, and it was famous for its corrosion resistance. Even today churches and cathedrals still have the forged iron gates and fences as bright as when they were made. They have withstood for many years the ravages of the atmosphere in Spain and abroad.

* * *

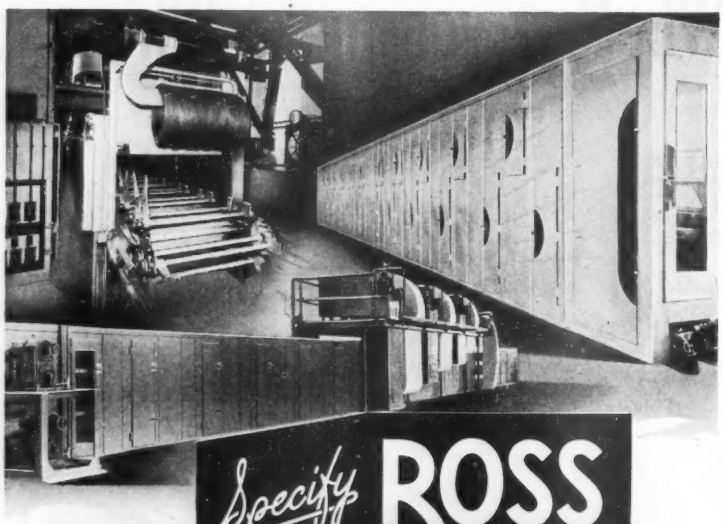
A list of books, international in scope, but mostly from the U.S.A., supplements, extensive and very up-to-date references (May 1947) on historical and modern work. **Wire and Wire Products** is mentioned for the papers by Imhoff on pickling inhibitors, (1946) and Morral on Corrosion, (1947). Subject matter and name index completes the book.

* * *

Pennsylvania Wire Laboratories Incorporates

THE **Pennsylvania Wire Laboratories**, Herndon, Pa., has been incorporated and **Sidney R. Dresser** elected President of the new corporation.

* * *



Ross Wire and Rod Baking Equipment is operating in plants of Alloy Rods Co., Arcrods Corp., Gilbert & Bennett Mfg. Co., Harnischfeger Corporation, International Nickel, McKay Co., Metal & Thermit, A. O. Smith Corp., Westinghouse Electric and others.

Specify ROSS WIRE and ROD OVENS

For drying the coatings on steel and alloy rods or for baking lime coating on wire, ROSS equipment provides design refinements and operating advantages that greatly increase output of better finished products. This accounts for their use in the leading plants throughout the industry. Write to our office nearest you for complete details.

ROSS SYSTEMS

J. O. ROSS ENGINEERING CORPORATION

MANUFACTURERS OF AIR PROCESSING SYSTEMS

350 MADISON AVENUE NEW YORK 17, N. Y.

201 N. Wells Street, CHICAGO-6 • 79 Milk Street, BOSTON-9 • 9225 Grand River Avenue, DETROIT-4 • 1231 E. Seventh Street, LOS ANGELES-21

ROSS ENGINEERING OF CANADA, LIMITED, MONTREAL 19, CANADA • CARRIER-ROSS ENGINEERING COMPANY, LIMITED, LONDON, ENGLAND

THE company has steadily expanded its facilities since its organization some years ago and is at present further adding to its capacity by installing fine copper wire drawing equipment and enameling ovens for fine sizes. This is the beginning of a very considerable expansion program that will extend over the next several years.

* * *

THEY now draw copper, stainless monel wires and engage in tinning, bunching, stranding and enameling, specializing in long lengths for insulators and stranding ferrous alloys to .002" diameter.

* * *

Folder on Surface Preparation

A leaflet issued by the **American Chemical Paint Company**, Ambler, Pa., gives information on the preparation of metals for painting through the use of Deoxidine. The metals to which it may be applied are iron, steel, aluminum and many others.

* * *

DEOXIDINE is a phosphoric acid metal cleaner and rust remover, which is supplied as a concentrate, coming in various grades for different applications. Copies of this leaflet will be sent to interested persons.

* * *

New Coating Metals Announced

PEELCOTE, a new protective coating for metal parts which can be easily and quickly peeled off after it has served its purpose, has been developed by the **Watson-Standard Company.**

* * *

THIS is an air-drying coating designed to protect from scratches, chips and corrosion during shipment, storage, handling and some types of fabrication. It can be applied by spray or dip methods and dries quickly. It is removed quickly and cleanly simply by pulling it off.

* * *

IT is a vinyl-based coating with complete chemical inertness. It is available in clear transparent or solid hiding black. Additional information will be supplied on request by the manufacturer, the Watson-Standard Company, 225 Galveston Ave., Pittsburgh, Pa.

* * *

New Inhibitor for Sulphuric and Hydrochloric Acids

ENTHONE, Inc., have announced the development of Enthone Inhibitor No. 9.

* * *

THIS is a liquid inhibitor that dissolves readily in acid solutions. The manufacturer states that this inhibitor is very important where exhaust ventilation is not available. Another feature is its inhibiting action in both hydrochloric and sulphuric acid solutions. In solutions of both hydrochloric and sulphuric acids, the inhibiting action is over 90% and in some cases ranging up to 98%.

* * *

THE inhibitor dissolves cleanly in the acid solution leaving no sludge or residue. Acid solutions, therefore, are easily rinsed off the work.

* * *

THE inhibitor is available as a liquid which dissolves very readily in the pickling solutions. It is suitable for use in both cold and hot pickles. Steel coated with scale, oxide, and rust can be quickly pickled without attack upon the base metal. Therefore, bright surfaces are left bright after pickling operations, the result being an improved product when simple pickling is done, or a better base for plating or hot coating.

* * *

WRITE Enthone, Inc., 442 Elm Street, New Haven, Conn., Dept. WWP, for literature and samples.

* * *

New Catalog of Automatic Spring Coiling Machines by E. A. Samuel Machine Company

A new catalog illustrating five of their automatic Spring Coilers and Automatic Helical Spring and Book Spiral Coiling Machines has just been printed by the **E. A. Samuel Machine Company**, designers, engineers and builders of high production automatic Wire Working Machinery, 107 S. Clinton Street, Chicago 6, Illinois. The catalog gives the details and specifications of Samuel's Segment Type and Popcorn Type of Spring Coilers, the various types and kinds of springs the machines will coil and cut and the details and specifications of two of Samuel's Coiling Machines used for the economical mass production of compression and extension springs or book binding spirals. Features claimed for the machines stress economy of operation, accuracy of production, fast, easy set-up and changeover, high production, top quality construction and materials throughout and truly automatic operation. A free copy of the new catalog may be obtained by writing the Samuel Company at the address given above.

* * *

All-Metal WIRE SPOOLS

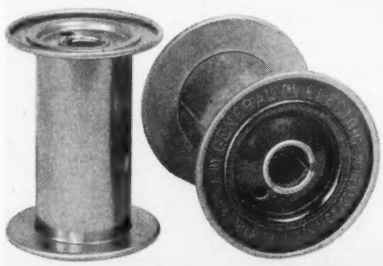
CABLE SPOOLS ... for Insulated and Rubber Covered Wire, Solder, and similar products.

Lightweight, all-steel, non-returnable Spools. Ends lithographed in your established color scheme and design.

Available in end diameters of 5", 6-1/2", and 10-1/2".

Ends and traverses may be shipped unassembled. A simple operation on a hand, foot, or power press makes a rigid assembly.

FINE WIRE SPOOLS ... for Winding and Shipping Fine, Steel, Copper, and Enameled Wires.



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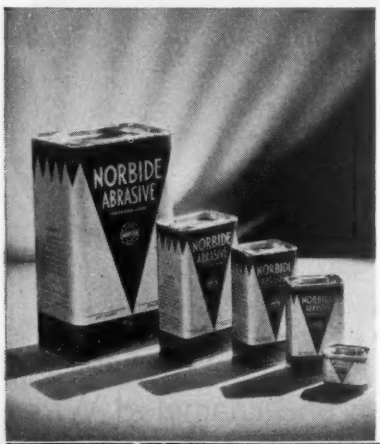

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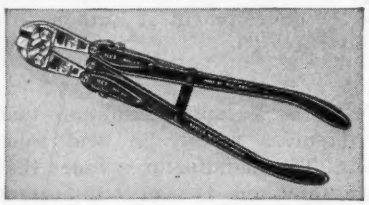
IN announcing their new redesigned improved complete line of Porter Hand Power Cutters featuring 15 improvements, **H. K. Porter, Inc.,** Somerville, Mass., stress a new degree of ease, strength, safety and performance in the cutting of bolts, rods, wire, cable, chain, bars and metal of all kinds. Of the 15 improvements these are cited as being



Porter Bolt Cutter * * * * *

of particular benefit to users; curved toe-in handles which decrease arm-spread and wrist bend making an easier and stronger pull, broad rounded palm-fit grip which reduces fatigue, no protruding screws or bolts to catch, metal safety handle stop, 30% greater tool strength in sections and handles, jaws plainly marked showing capacity and type of metal safety cut, and red color finish. All standard models have all new features. A new folder is offered describing the company line and recommending the cutter that should be used for each kind of cutting job.

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European Notes

SWISS manufacturers have secured German skilled labour from the needle industry in Aachen and the wood screw districts of various Rhenanian towns and are increasing production, with the apparent purpose to export more. Swiss wood screws are now sold in the Near East and recently a Swiss sample show has been opened at Bombay, India.

* * *

SWEDEN is offering at present steel wood screws at 79% discount off the British standard list f.o.b. Swedish ports and brass wood screws at 67½%. Business had been rather brisk during the first half of this year, but has fallen off in the last months. German competition in this line is not felt and the Czechoslovakian industry has not yet restarted exporting.

* * *

MOST European wire markets are overstocked, with the exception of course of Germany and the Balkan countries. Stocks in Belgium, Holland and Scandinavia are full and prices are slightly receding. The industry however is still running at the maximum possible capacity.

* * *

THE German wire industry does not show any signs of a recovery. In September the industry in the British zone was running at 46% of the present capacity and in October at 43%. In the American zone at 42% respectively 40% and in the French at 55% and 53%. It must be taken into consideration, that the present capacity in the British-American zone is only about 45% of what it was in 1938 and in the French 40%. Furthermore: The production per man hour has formidably decreased and is at present only about 50% of what it was in 1938. This is due to the reason, that obsolete machinery could not be replaced, that no machinery had been properly repaired for years and that due to undernourishment the workmen are unable to work as they did before. In the Russian Zone approximately 70% of the whole machinery in wire and wire products works has been dismantled.

* * *

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ON the export markets, African Colonies have been buying better than in the months before, but the demand from Latin America has further decreased and Asiatic markets are quiet. Some orders are now coming from India, where during the disturbances between Mohammedans and Hindus the August-September buying had declined to almost nothing. Prices are fairly maintained.

* * *

SPANISH production of wire rods has been 18,700 tons during the first 9 months of this year, which is inadequate to the demand. A wire rod mill at Cartagena, idle many years has been re-installed and will start producing at a rate of approximately 8,000 tons annually. The official prices have been left unaltered, producers are however permitted to charge higher rates to the manufacturing industry. The "unofficial prices" are about 70-80% above official rates.

* * *

THE Austrian wire industry is still suffering from the heavy toll Russian occupation and demontage has had on the capacity. The Styrian high quality producing works are not yet in a state to produce, but the wire rope production has been restarted at a moderate scale in Carinthia near Klagenfurth. In the Vienna district only 2 plants out of 14 are operating, all others have completely stripped off the whole plant equipment.

* * *

THE Belgian wire industry is very busy and operates at approximately 90% of capacity. The industry has suffered very little by war actions and what damages existed have been repaired. In the year 1947 approximately 65% of the total output was sold for export not including the Belgian Congo. Of total exports British India (or Pakistan and Hindustan now) took 21%, England 4%, South Africa 6%, British African Colonies 5%, Holland 3%, Sweden 4%, Canada 2%, Palestine 7%, Brasil 6% etc. Exports are very diversified and do not focus on some special markets

only. The present Belgian export prices are about 5% lower than the American, though according to different markets, different quotations are issued.

* * *

THE recent Czechoslovakian-Russian trade agreement includes more Czech wire products for export to Russia. It is expected that in the year of 1948 the Czechs will sell approximately 5.000 tons of wire nails, a same quantity of barbed wire and 6.000 tons of telegraph and telephone wire and a few hundred tons of wire ropes to Russia. Russia is negotiating for the purchase of 3.000 tons of hexagonal and square wire netting.

* * *

THE German wire mesh industry, situated mainly in the district of Thuringia, now Russian occupied zone has restarted exporting on a moderate scale. The price of a 50′ roll of mesh of Nr 30 grade yellow painted is $1.75 fob Hamburg. So far the industry has not sold more than 3-4000 rolls in total.

* * *

THE price permitted to quote for hexagonal wire netting for export has been fixed by the JEIA (Joint Export and Import agency) in Germany at 75% off the British Standard list fob. This price is considered generally as too high to permit business, particularly as only payment in dollars is accepted even for products manufactured in the British occupied zone of Germany.

* * *

THE French wire industry has not yet recovered from war damage and after war disturbances. The present capacity is estimated to be approxmately 15.000 tons per month, which is considerably less, than before the war. The actual production is approximately 12.000 tons monthly and is not sufficient to cover the whole demand, so that no quantity noteworthy to speak of can be offered for export.

* * *

SWEDEN has stopped all import permits for high carbon wire rods of mild steel quality (Thomas), such as used by numerous Swedish wire manufacturers. Main source of supply was hither to Luxembourg. Exchange difficulties are the reason.

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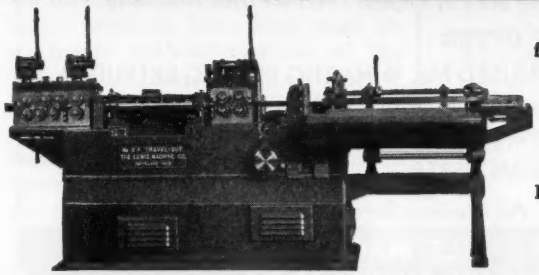

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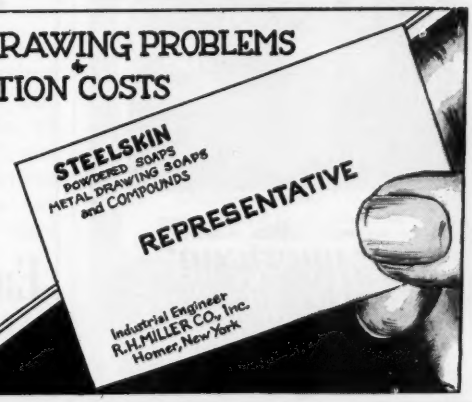

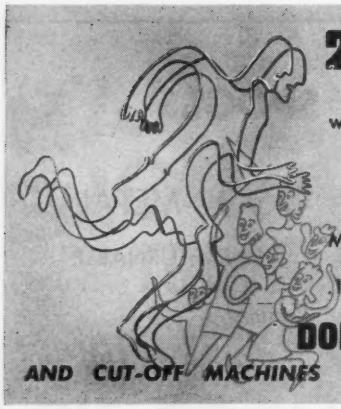

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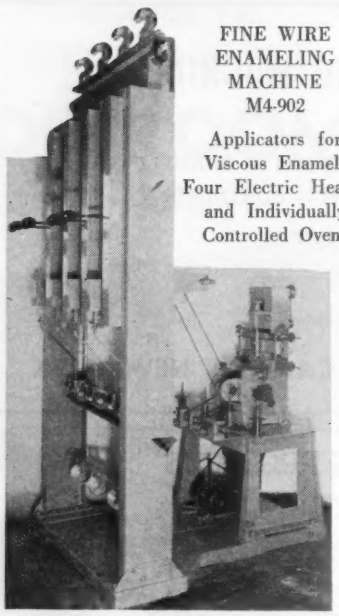

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SWISS production of aluminum wire for high power transmission lines has been 9.200 tons in the first 11 months of 1947. The whole of it has been consumed in Switzerland and Italy, to other countries nothing has been exported.

* * *

Large Hydraulic Plate Stretcher-Leveller of New Design

A Stretcher-Leveller of special design, believed to be the largest ever made, was recently built by **Hydropress, Inc.**, New York. The machine which is shown in the picture after shop erection, is of the self-contained oil hydraulic type, has a capacity of 825 tons and is adapted to accommodate plates or sheets up to 100" wide. The maximum length of the plates is 33' and the minimum length 7'. Two gripheads are provided of which one is actuated by the hydraulic stretching cylinder, while the position of the other one is adjustable to compensate for the varying length of the plates. Operation of the machine is effected by remote control from the operating panel. Pressure adjustment over a wide range is provided for handling thinner and narrower plates at the accurate required pressure.

* * *

Labor Relations

(*Continued from page* 234)

THIS sudden about face is taken by observers as an indication that the bosses of the big federation are beginning also to feel the pressure of rank and file demands and unrest.

* * *

WHAT it all adds up to for manufacturers of wire and wire products is this stormy weather ahead; proceed cautiously.

* * *

Corrosion Inhibitors in Theory and Practice

(*Continued from page* 226)

furic acid. The presence of copper ions was found to be deleterious to this protection. This is undoubtedly due to the deposition of copper, which does not have the suppres-

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sive effect on hydrogen evolution which arsenic possesses.

* * *

IN sulfuric acid this inhibitor was of little value with lead, admiralty metal, or brass. It was partially effective with monel metal. The inhibitors of this class are most effective for ferrous alloys in acid media and are not effective in neutral or basic water solutions.

* * *

Organic Materials

ALL classes of polar organic compounds have been investigated for inhibitive properties. In addition, many mixtures have been used industrially without analysis of the active ingredients. Examples of these are **Dupont Nos. 3 and 8, Monsanto Hibitite, Rodine No. 67** and **Tarnavoid No. 1.** Organic inhibitors have been used to a large extent for preventing acid attack, but they are also effective in water and salt solutions.

* * *

THE most effective oxygen-containing compounds are the carboxylic acids and ketones which have been used as inhibitors in corroding gas wells. A large number of patents have been issued to cover inhibitors for acid cleaning baths.[26] The total number of substances listed exceeds several hundred. A series of patents [27] claim that certain long chain dicarboxylic acids, containing a sulfur, selenium, or tellurium atom somewhere in the chain are effective in reducing the corrosion of steel in water or salt solutions.

* * *

BRASS bearings have been protected from attack in groundnut or mineral oil by either oxalic acid or ethyl oxalate. Brass is also affected by rapeseed oil at 150°C and may be protected by adding succinic acid to the oil. In the above two cases the amount of inhibitor used was 0.05 weight per cent.[28]

* * *

ALDEHYDES and alcohols have not been widely used except for formaldehyde which is used

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for
Wire Drawing

After pickling, BORAX can be applied with one dip; dries in three minutes in an oven temperature of 150° F. to provide a coating that will not check or flake off in storage. Dissolves readily in water and is dust free. BORAX, other than being an excellent vehicle for picking up the drawing lubricant, is rust inhibiting and a natural flux that will facilitate the making of good butt welds. Use BORAX to make better wire at less cost. Used in many mills.

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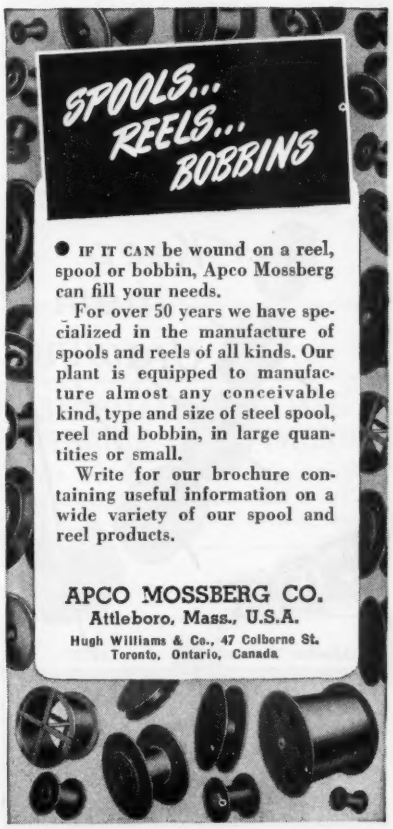

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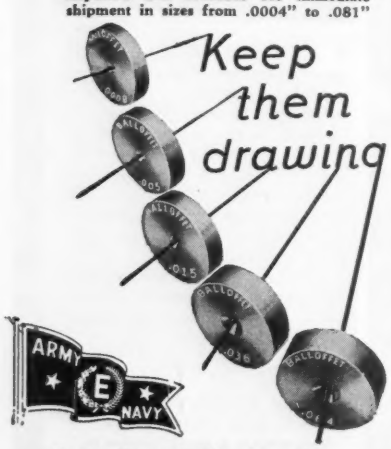

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to reduce sulfide corrosion in producing oil wells.[29] It is claimed to be 80 per cent effective in reducing the attack of brine saturated with H_2S or of acid solutions on steel. Two mechanisms have been proposed for the effect of this compound. One involves the formation of a polymer of formaldehyde with sulfur while the other states that a reaction occurs between the formaldehyde and sulfides with the product of the reaction forming a thin film on steel.[30]

* * *

IN general alcohols are not effective as inhibiting agents although an increased number of hydroxyl groups seems to improve the effectiveness of an organic compound. This is shown by the value of chromate glucosates in reducing corrosion in water systems.[31] These compounds are derivatives of glucose which contains six hydroxyl groups.

* * *

PROBABLY the most widely used compounds are those containing nitrogen and sulfur. Certain heterocyclic nitrogen compounds are the most effective known for the prevention of acid attack on steel as well as other metals and alloys but opinion varies on the value of aliphatic and aromatic amines. One author[32] reports that these compounds are very effective while another states that they give only moderate protection for the same type of attack.[33] Both observations were made for acid attack on steel.

* * *

THE number of sulfur containing compounds which have been used are limited. They consist chiefly of substituted thioureas which were patented about 20 years ago and mercaptobenzothiazole.

* * *

DIETHYLTHIOUREA and dibutylthiourea are now produced commercially as inhibitors. Mercaptobenzothiazole has been successfully used for pipelines carrying petroleum products.[34]

* * *

A separate class of substances which have sometimes proved effective are those which disperse colloidally. An example is gelatine which is said to retard the action

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of sulfuric acid on iron if the concentration exceeds 1.25 per cent by weight.[10] Oil in water emulsions have been added to water circulating systems to protect steel coolers. The oil is said to form a thin film on the steel. Some work has been done with soaps on phosphated steel surfaces.[35] It was shown that an alkaline lubricating soap was taken up on the surface of the phosphate coating, but an acid soap entered the pores of the layer.

* * *

DUE to the empirical selection of many inhibiting agents, certain materials do not fall readily into any of the above classes. Among these are raw sugars, both beet and cane, which inhibit the attack on iron of water and salt solutions. The raw beet sugar is the more effective. The inhibitive properties are due to impurities since the refined products are not effective. Another material, developed empirically, is obtained by evaporating a solution of sodium chloride or sulfuric acid containing a linseed meal extract.[36] The product is said to be very effective in preventing acid attack on steel.

* * *

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Electrical Applications in the Wire Industry

(*Continued from page* 220)

mainder of the field range, which normally is 3-to-1 or 4-to-1 total, is used to obtain an adjustable delivery speed. This means, then, that a wide range of delivery speeds is not obtainable with this setup since a good portion of the range is needed for synchronization, and if an extremely wide range is required it is necessary to go to an adjustable voltage control system. The adjustable voltage, or Ward-Leonard, system also has the advantage in that it provides smoother operating characteristics, operation from the a-c line, and all of the other advantages of an adjustable voltage system. A typical control panel for a six-motor wire drawing machine of this type which utilizes the adjustable voltage control is shown in Fig. #18. Fig. #19 is a back view of the same panel and shows the motor operated rheostat which is used to obtain a timed acceleration and deceleration.

* * *

A Look Into the Future

THIS gives something of the story of what has been done with wire drawing machines, and what we are doing now. The next logical question is "Where do we go from here?" Of course, the industry is continually increasing speeds and quality of the wire being drawn, but beyond that probably the greatest advances in the wire drawing art will be in the field of "reactive wire drawing." Tests have definitely proven that holding back tension on the wire before it enters the die decreases the amount of power required to draw the wire and decreases the heating of the die. Since die heating is one of the limitations of the speed of drawing wire, this is important because by reducing die heating, the drawing speed can thereby be increased. By increasing the back tension to a high enough value, it has been found that the wire may actually elongate due to the stretching, thus reducing the work that the die has to do.

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THIS method of drawing wire with back tension is called "reactive wire drawing," and may very well be the field in which the next major wire drawing developments will take place.

* * *

Portsmouth Steel Corporation

(*Continued from page* 233)

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* * *

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Index To Advertisers

A

Acrometal Products, Inc. ..... 230 & 231
Ajax Industrial Supplies, Inc. 263
Aluminum Company of America 203
American Chemical Paint Co. 252
American Insulating Machinery Company 260
American Steel & Wire Co., The 205
Anchor Wire Corporation 263
Apco Mossberg Company 261

B

Balloffet Dies & Nozzle Co., Inc. 262
Bethlehem Steel Co. 190
Bick, Hans C., Inc. 263
Bridge Mfg. Co., Inc., The 256

C

Carboloy Company, Inc. 189
Carl-Mayer Corp., The 238
Ceilcote Company, The 262
Champion Diamond Co. 263
Clark, J. L., Mfg. Co. 255
Cleveland Tramrail Division of the Cleveland Crane & Engineering Co. 198
Cochaud Wire Die Corporation 263
Continental Steel Corp. 200
Columbia Steel Corp. 205
Crepe-Kraft Co., The 264

D

Davis Electric, R. L., The 246
Dore Manufacturing Co. 260
Durant Mfg. Co. 265
Du Pont, E. I. de Nemours Co., Inc. 199
Durkee Mfg. Co. 259

E

Eastern Tungsten Carbide Co. 263
Eastwood-Nealley Corp. 260
Ecca Machine Corp. 265
Eisler Engineering Co. 264
Electric Furnace Company ..... Back Cover
Emory, Robert J., Company 265
Entwistle, James L. Co. 191

F

Firth-Sterling Steel & Carbide Company 212
Fort Wayne Wire Die, Inc. 263
Furnace Engineers, Inc. 264

G

General Electric Co., The 204
Glader, Wm., Machine Works 240
Gordon, Clark E., Inc. 264

H

Haveg Corporation 264
Hoosier Carbide Die, Inc. 263
Howsam Spool Co. 266
Hubbard Spool Company 197
Hudson Wire Co. 196
Hughesville Machine & Tool Co. 241

I

Indiana Wire Die Company 263
Industrial Ovens, Inc. 264

J

Johnson Steel & Wire Co., Inc. 257

K

Kelly Wire Die Corporation 263
Kenmore Metals Corp. 264
Keystone Steel & Wire Co. 236

L

Lancaster, Allwine & Rommel 266
Laribee Machine Co., Inc. 259
Lewis, K. B. 266
Lewis, Machine Co., The 259

M

Magnus Chemical Co. 192
Malin & Company, The 265
Metal Carbides Corporation 264
Micro Products Company 235
Miller, R. H. Company, Inc. 259
Montgomery Company, The 265
Morgan Construction Company 210
Mossberg Pressed Steel Corp. 248

N

National Annealing Box Co. 266
National Machinery Exchange 266
Nelson Company, The 265
New England Butt Company 207
New England Wire Die Co. 263
Niles Steel Products Div., Republic Steel Corp. 211
Nilson, A. H. Machine Co., The 265
Norton Company, The 256

O

Oakite Products, Inc. 261
O'Neil-Irwin Mfg. Co. 265
Owens-Corning Fiberglas Corp. 206

P

Pacific Coast Borax Co. 261
Parkin, Wm. M. Co., The 265
Paramount Wire Company 264
Pittsburgh Cut Wire Co. 249
Platt Brothers & Co., The 265
Porter, H. K., Inc. 262
Potter, Neil C. 266

R

Reed & Richards Transatlantic, Inc. 251
Robertson, John Co., Inc. 194
Roebling's, John A., Sons Company 193
Roos, H. & G., Tool & Mfg. Co. 258
Ross, J. O., Engineering Corp. 254
Royle, John & Sons 243
Ruesch, H. J. Machine Co. 266
Rusch Wire Die Corporation 263

S

Sauereisen Cement Co. 265
Sciaky Bros., Inc. 253
Scott Testers, Inc. 264
Scudder, E. J., Foundry & Machine Co. 264
Shuster, F. B., Mfg. Co., The 237
Sleeper & Hartley, Inc. 264
Standard Industrial Compounds Co. 201
Standard Vanish Works 247
Steel Equipment Co. 245
Surface Combustion Corp. 266
Syncro Machine Company 202

T

Trauwood Engineering Co. 266
Twitchell, E. W., Inc. 258

U

Union Wire Die Corp. 244
U. S. Steel Co. 205

V

Vascoloy-Ramet Corp. 208
Vaughn Machinery Co. ..... Front Cover
Vianney Wire Die Works 262

W

Warren, Thread Works, Inc. 266
Waterbury Farrel Foundry & Machine Co. 265
Watson Machine Company ..... Inside Back Cover
Wayne Wire Die Co. 263
Wean Equipment Corp. ..... Inside Front Cover
Willey's Carbide Tool Co. 257
Wilson, Lee, Engineering Co., Inc. 265
Wire & Textile Machinery, Inc. 260

Y

Youngstown Sheet & Tube Company 195

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CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Champion Diamond Co., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Champion Diamond Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Union Wire Die Corp., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND TOOLS—
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Lead Extrusion
Eastern Tungsten Carbide Co., Newark, N. J.
Wayne Wire Die Co., Hillside, N. J.
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Sintered Carbide
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Special Shapes, Etc.
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.

DIES—Tubing
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Hoosier Carbide Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp. Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIRECT ELECTRIC RESISTANCE HEATING—
Trauwood Engr. Co., Cleveland, Ohio.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N.J.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.

WHERE TO BUY, Continued

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro. Mass.

DRYING & PRE-HEATING ROOMS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N.Y.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Elec. Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros., & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Hayes C. I., Providence, R. I.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Furnace Engineers Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Hayes, C. I., Providence, R. I.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., The, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Co., Inc., Philadelphia, Pa.

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Hanson-Van Winkle-Munning Co., Matawan, N.J.

GAVANIZING FLUXES—
Hanson-Van Winkle-Munning Co., Matawan, N.J.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M. Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Crepe-Kraft Co., Newark, N. J.
Du Pont de Nemours, E. I., Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Owens Corning Fiberglas Corp., Toledo, O.
Standard Varnish Wks., Staten Island, N. Y.
Twitchell, E. W., Philadelphia, Pa.
Warren Thread Works, Inc., New York, N. Y.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.
Swift & Company, Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bale Tie
Reed & Richards Transatlantic Inc., New York, N.Y

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Laribee Machine Co., Inc., Camden, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Entwistle, Jas. L. Co., Pawtucket, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Coilers
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Laribee Machine Co., Inc., Camden, N. Y.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (used), New York, N. Y.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Machinery Inc., Pawtucket, R. I.

MACHINERY—Copper Wire Drawing and Rolling
Aetna Standard Eng'g Co., The, Youngstown, O.
American Insulating Mach'y Co., Phila., Pa.
Laribee Machine Co., Inc., Camden, N. Y.
National Machinery Exchange (used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Dore Manufacturing Co., Inc., Grayling, Mich.
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Porter, H. K. Inc., Everett, Mass.
Shuster, F. B. Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Union Wire Die Corp., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Aetna Standard Eng'g Co., The, Youngstown, O.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Laribee Machine Co., Inc., Camden, N. Y.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

MACHINERY—Extruding
National Erie Corp., Erie, Pa.
National Rubber Machinery Co., Akron, Ohio.
Robertson John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R. I

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Dore Manufacturing Co., Inc., Grayling, Mich.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Forming
Eisler Engineering Co., Newark, N. J.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Reed & Richards Transatlantic Inc., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
National Erie Corp., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail, Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Plating Electrolytic
Hanson-Van Winkle-Munning Co., Matawan, N.J.
Kenmore Metals Corp., New York, N. Y.

MACHINERY—Pointing
Aetna Standard Eng'g Co., The, Youngstown, O.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rubber Insulating
National Rubber Machinery Co., Akron, O.

MACHINERY—Rubber for Insulating Wire
National Rubber Machinery Co., Akron, O.
Royle, John & Sons, Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Rubber Tubing and Straining
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Kenmore Metals Corp., New York, N. Y.
National Erie Corporation, Erie, Pa.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Laribee Machine Co., Inc., Camden, N. Y.
National Mach'y Exch. (Used), New York, N.Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Reed & Richards Transatlantic, Inc., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Dore Manufacturing Co., Inc., Grayling, Mich.
Lewis Machine Co., The, Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
Hughesville Machine & Tool Co., Hughesville, Pa.
Laribee Machine Co., Inc., Camden, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Ruesch, H. J., Machine Co., Newark, N. J.
Steel Equipment Co., Cleveland, Ohio
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
National Erie Corp., Erie, Pa.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Laribee Machine Co., Inc., Camden, N. Y.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Testing Physical
American Optical Co., Buffalo, N. Y.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.
Scott Testers, Inc., Providence, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Laribee Machine Co., Inc., Camden, N. Y.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila, Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
National Erie Corp., Erie, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila, Pa.
Eisler Engineering Co., Newark, N. J.
Laribee Machine Co., Inc., Camden, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Aetna Standard Eng'g Co., The, Youngstown, O.
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Aetna Standard Eng'g Co., The, Youngstown, O.
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Laribee Machine Co., Inc., Camden, N. Y.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N.Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail, Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Procter & Gamble, Cincinnati, Ohio.
Standard Industrial Compounds Co., Chicago, Ill.

WHERE TO BUY, Continued

OPTICAL EQUIPMENT—Metallurgical
American Optical Co., Buffalo, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER—For Coil Wrapping and Corrosion Prevention
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott Testers, Inc., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING EQUIPMENT—Acid Resisting
Gordon, Clark E., Detroit, Mich.

PICKLING—Hooks for—
Gordon, Clark E., Detroit, Mich.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Ceilcote, Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

PLATING PROCESS—Electrolytic
Hanson-Van Winkle-Munning Co., Matawan, N.J.
Kenmore Metals Corp., New York, N. Y.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

POTS—Lead Melting
National Annealing Box Co., Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Industrial Ovens, Inc., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REEL STANDS—Pay Off & Take Up
Dore Manufacturing Co., Inc., Grayling, Mich.

REELS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Nelson Company, The, Baltimore, Md.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Takeoff
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., Hazardville, Conn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Nelson Company, The, Baltimore, Md.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Drawing
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Mill
Durkee Mfg. Co., Pine River, Minn.

REELS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
Nelson Company, The, Baltimore, Ind.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N.Y.

RODS—Nickel Alloy
Eastwood-Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N.Y.

RODS—Stainless Steel
American Rolling Mill Co., The, Middletown, O.

RODS—Wire—Non-Ferrous
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy, Inc. Pawtucket, R. I.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
American Rolling Mill, Middletown, Ohio.
Continental Steel Corp., Kokomo, Ind.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison N. J.
Potter, Neil C., Newark, N. J.
Procter & Gamble, Cincinnati, Ohio.
Swift & Company, Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Acrometals Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

SPOOLS—Shipping and Shop
Acrometals Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark Mfg. Co., J. L., Rockford, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp.,

SPOOLS—Steel
Acrometals Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark Mfg. Co., J. L., Rockford, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

SPRINGS—Tools for Forming
State Machine Tool Co., Hartford, Conn.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.

TANK—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Penna.

TINSEL—Cords, Decorative
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Electric Conductor
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Electric Resistance
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Lame, Silver and False Gold
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Thread, Silver and False Gold
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Thread, Decorative
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Laribee Machine Co., Inc., Camden, N. Y.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy, Inc. Pawtucket. R. I.

TREADS—Safety
Norton Co., Worcester, Mass.

TUBE BENDERS AND FORMERS—
Ruesch, H. J. Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
Standard Varnish Wks., Staten Island, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Sciaky Bros., Inc., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y. Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy, Inc. Pawtucket, R. I.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Rolling Mill Co., The, Middletown, O.
American Steel & Wire Co., Cleveland-Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
North American Philips Co., Inc., New York, N.Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
American Rolling Mill Co., The, Middletown, O.
American Steel & Wire Co., Cleveland-Chicago & New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., of Colorado Fuel & Iron Corp., Buffalo, N.Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Nickel & Nickel Alloy
Eastwood-Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N. Y.

WIRE—Music
Ecca Machine Corp., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.
Paramount Wire Co., 100 Bleecker St., New York, N. Y.

WIRE—Nickel Silver and Phosphor Bronze
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
Anchor Wire Corp., Jamaica, N. Y.
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., New York, N.Y.
Paramount Wire Co., 100 Bleecker St., New York, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRESERVING—Paper and Cotton
Paramount Wire Co., 100 Bleecker St., New York, N. Y.

WIRE—Spring
American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Rolling Mill Co., The, Middletown, O.
American Steel & Wire Co., Cleveland-Chicago-New York.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Paramount Wire Co., 100 Bleecker St., New York, N. Y.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting—
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARNS & TAPES—
Du Pont de Nemours, E. I., Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Owens Corning Fiberglas Corp., Toledo, Ohio.
Twitchell, E. W., Philadelphia, Pa.
Warren Thread Works, Inc., New York, N. Y.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

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Wire & Wire Products
March, 1948

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

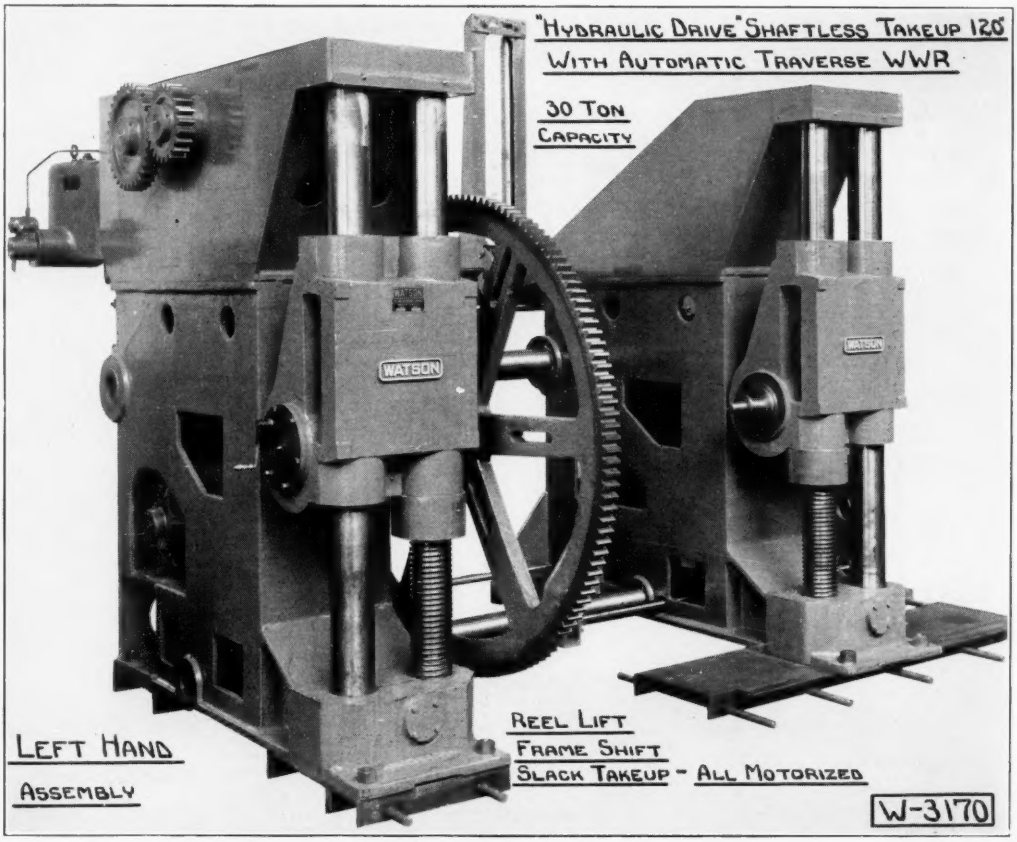
HEAVY DUTY SHAFTLESS TAKE-UPS — TYPE "V"

Available in many Model and Size Combinations, at once obvious advantages are:—

A.—GREATEST EASE OF REEL ENTRANCE AND EXIT.
B.—RAPID, MOTORIZED ADJUSTMENTS OVER WIDE REEL RANGE.
C.—ELIMINATION OF ACCIDENTS DUE TO REEL SHAFT HANDLING.

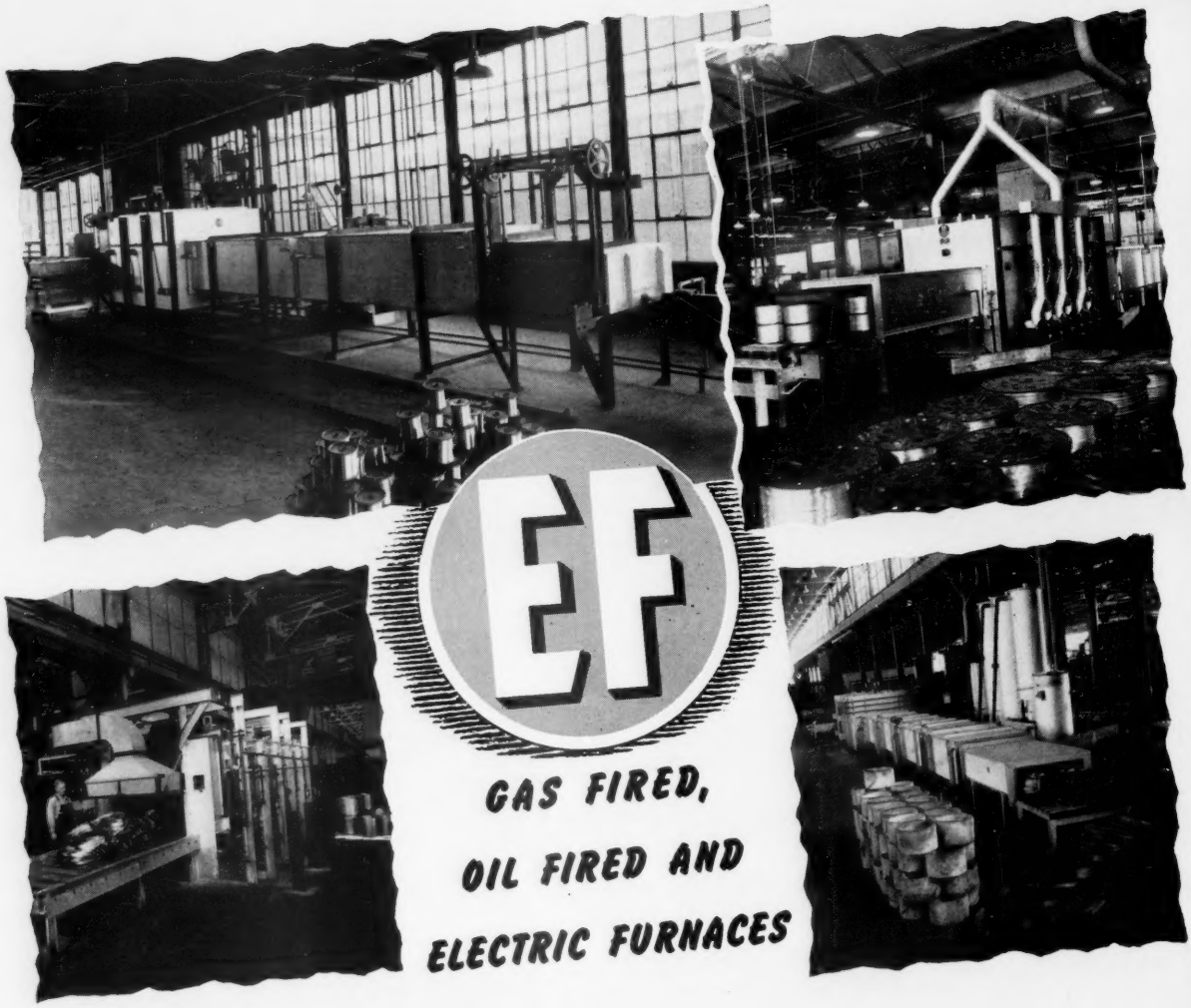
* * *

Model shown here (Special "Left Hand" Assembly) is HYDRAULIC "NO-SLIP ENERGY-LOSS" DRIVEN producing constant tension in Cable or Rope. For use on Stranding, Closing and Related Machines.



REEL SIZE Maximum	72″	84″	96″	110″	120″
FLOOR PICK-UP Minimum	36″	36″	48″	48″	43″
LOAD CAPACITY in Tons	6	6	10	30	30

* * * *Machine Bulletins on this and other Types on request.* * * *



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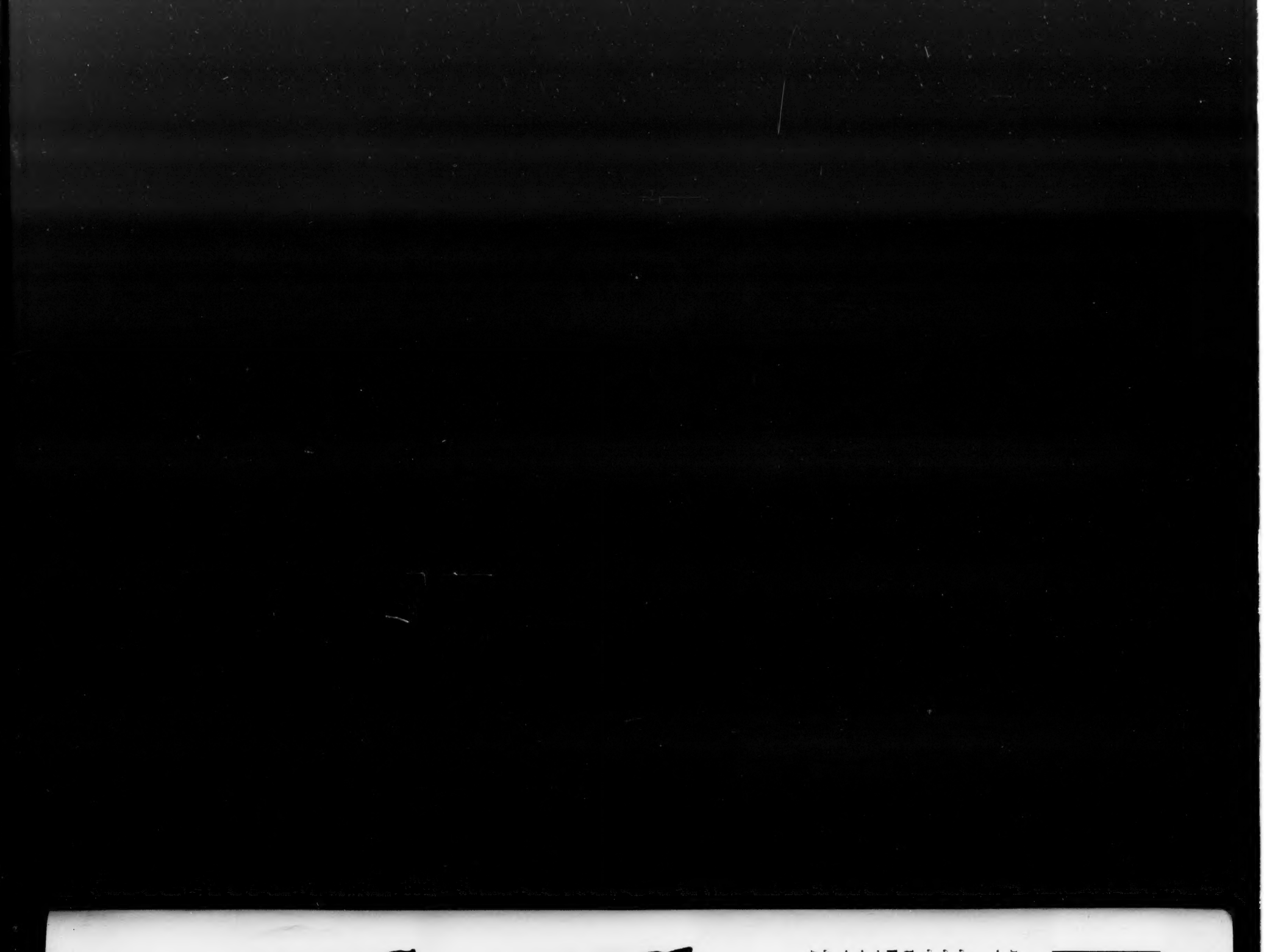
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